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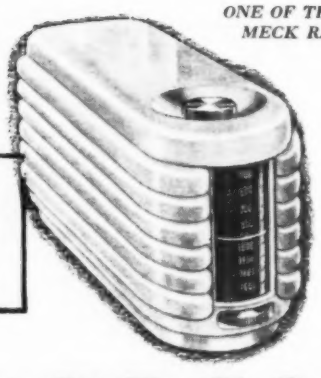

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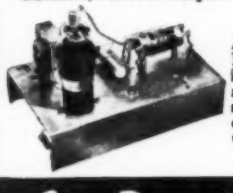

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MARCH • 1945

VOLUME 33, NUMBER 3

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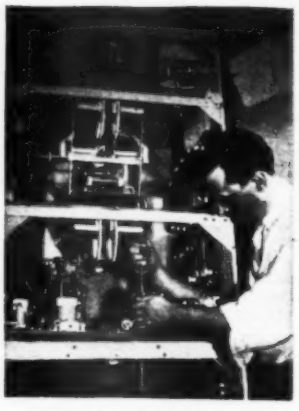

COVER PHOTO

By Frank Ross
(Staff Photographer)

Adjusting transmitter at Farnsworth plant before shipment to Civil Aeronautics Administration. This unit is used in conjunction with Fan Marker Systems.

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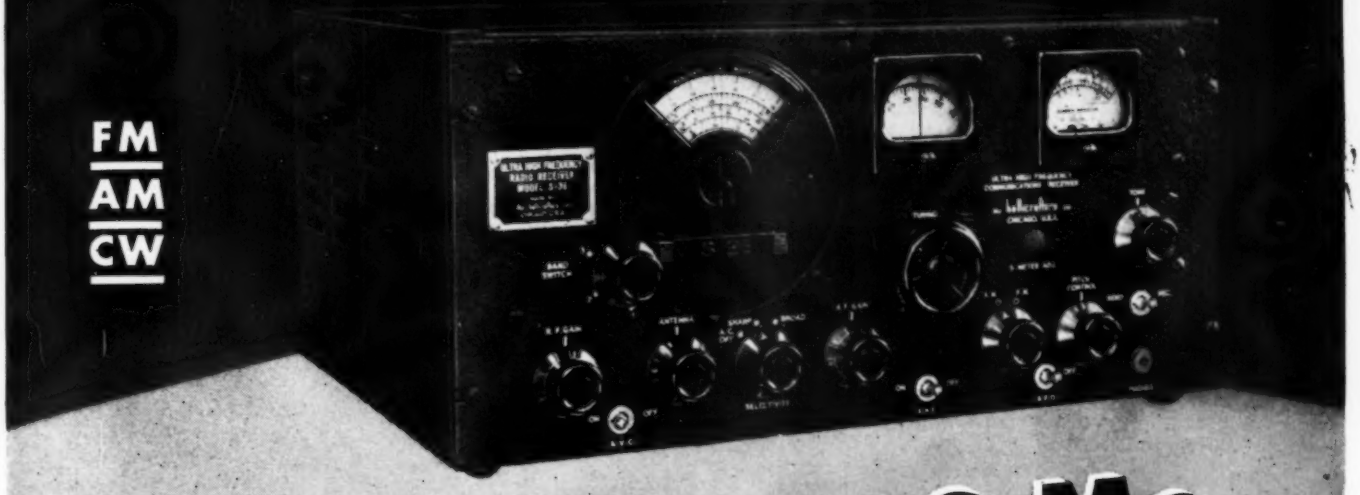

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FOR THE RECORD

by the editor

WIDESPREAD spectrum allocations by the FCC will result in hundreds of new services for radio communications. Although final decisions have not been made, and will not be made until arguments have been presented, the results finally arrived at will affect everyone connected in any way whatsoever with the radio-electronic industry.

The proposed allocations are concerned with the spectrum between 25,000 kc. and 30,000,000 kc. Coming in for their share are many new services, some of which have been in the development stage for some time. They include urban transit, forestry and conservation, power, petroleum, special emergency, geophysical, general highway mobile, experimental, motion picture, relay press, provisional, railroads, and many others.

Of particular interest to the man on the street is the allocation of a spectrum known as the citizen's radiocommunication service. This band is 10,000 kc. wide and is proposed to be from 460-470 mc. The FCC points out, however, that other services will occupy bands on each end of this spectrum and provision can be made for expansion if necessary. The FCC realizes that farmers, doctors, and even the travelling salesman, or business man, will probably in the not too far distant future possess his own two-way walkie-talkie, or handie-talkie. Of course, there are endless uses for such portable equipment.

Of particular note is the proposed change which will move FM frequencies to the region of 84-102 mc. While it is true that only 500,000 receivers will be outmoded, it will present hardships to others who have purchased FM tuners in considerable quantity. Some of these tuners can be converted to include the new FM bands and others cannot.

Another major move is to shift television to the region of 44-50 and 54-216 mc. Tentatively assigned would be a total of twelve channels in the television spectrum. The service dealer should not be too concerned about these changes inasmuch as he has proper explanation for disappointed customers.

Amateurs, as predicted in this column many months ago, receive many channels upon which they may operate. The door is wide open for their further experiments. They will again have the opportunity of helping to make the new spectrum usable and their contributions will go far to prove that communications *will* and *can* find widespread use in the higher regions.

WE have stressed the importance of becoming "sales-minded." This becomes imperative if the serviceman is to survive the avalanche of potential competition which he will face post-war. We must not forget the huge sum of enlisted personnel who have received specialized training in radio operation and in maintenance of equipment. The Army, for example, has now trained over 128,000 men, 15,000 officers and nearly 2,000 Wac's alone. In addition, we find that the Air Corps has trained 20,000 radio ops and maintenance men annually and the Navy adds another 110,000 on its roster of personnel that have received training.

The Government is now engaged in a study of finding locations for returning G.I.'s. It is estimated that more than 40,000 radio repair men will at least consider entering the radio repair business. How many of these will make the positive decision is not as yet known. But, even though the percentage be small, it will offer lively competition to existing service establishments. Not all of the men entering the service business will own their own shops, even though Uncle Sam is now offering financial help to those who can qualify. Many G.I.'s will be absorbed into the entire industry by manufacturers, by the railroads, and all other services using communications. But, there will still be plenty left in the pool and jobs must be found for all of them.

The widespread use of frequencies in the higher regions will make it most necessary for aggressive service dealers to hire returning G.I.'s who have received specialized radar and other u.h.f. training. These men, for the most part, will be far better equipped to service and maintain new high-frequency gear than many of the old timers who have spent their entire business careers servicing broadcast sets in the present AM band.

Realizing that the serviceman's entire technique will have to be changed, augmented, or both, the editors of RADIO NEWS will present special features in the April issue that will be of concrete help to those faced with the common problem.....O.R.

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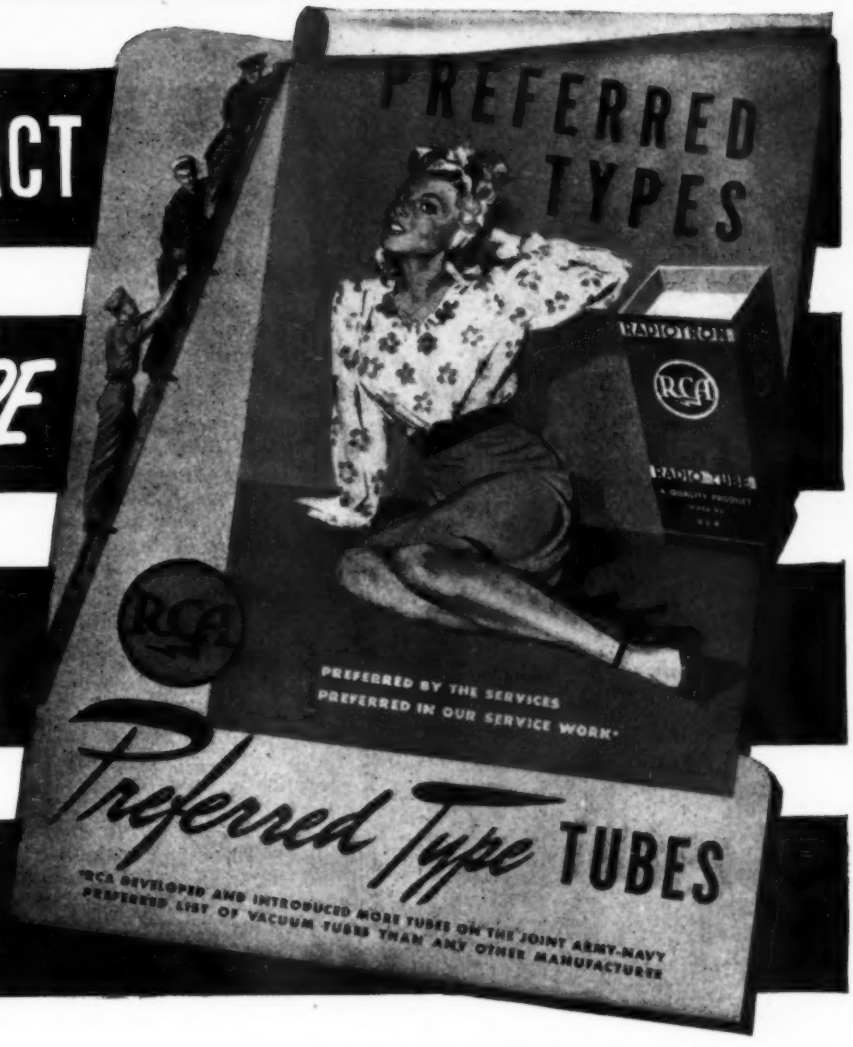

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Spot Radio News

By RADIO NEWS Washington Correspondent

Presenting latest information on the Radio Industry.

WASHINGTON BRISTLED WITH ACTIVITY during the first month of the year. We saw the House Select Committee, investigating the FCC Commission, conclude its two-year study with decisive conclusions: the appointment of Paul A. Porter as Chairman of the FCC and publication of the FCC reallocation frequency proposal for 25-30,000 megacycles.

The House Select Committee report proposed a substantial revision of the Communications Act. Congress was asked to study and revamp the clause covering "public interest, convenience, and necessity." The report also disclosed a request for Congress to review newspaper ownership, clarifying the problem by perhaps introducing legislation. Temporary licenses were frowned upon in the report, with a request that all effort be made by the FCC to limit use of such licenses.

A joint committee consisting of FCC representatives and members of the industry who might study legislative changes was also proposed. It is expected that standing committees now in force, such as the subcommittee on communications, probably will contribute to the legislative proposals. The Select Committee probably will be discontinued according to Chairman Clarence F. Lea, who is also head of the Intrastate and Foreign Commerce Committee which might conduct hearings on legislative revisions.

The report gave the engineering staff of the FCC a green light to study postwar expansion of all broadcasting, and to employ the necessary technical personnel to secure such information. A substantial monitoring staff to insure against unauthorized use of frequencies was also approved in the report. The Radio Intelligence Division, which had been severely criticized, was highly complimented by the committee. And the Foreign Broadcast Intelligence Service also received a note of approval, the report indicating that the FCC was the logical body to provide this service.

The committee praised former FCC chairman James Lawrence Fly for his work. The report stated that he had assumed unquestioned leadership, and although he was arbitrary at times during hearings, he nevertheless contributed materially to the better functioning of the Commission. The report also went on to say that Mr. Fly left the Commission in a better shape than he found it

The Select Committee consisted of, in addition to Representative Lea, Representatives Edward J. Hart (Democrat, New Jersey), J. Percy Priest (Democrat, Tennessee), Representative Louis E. Miller (Republican, Missouri), and Richard B. Wigglesworth (Republican, Massachusetts).

AFTER SERVING AS FCC CHAIRMAN on a recess appointment, Paul A. Porter's appointment was finally confirmed by the Senate. On December 21, President Roosevelt named Mr. Porter as FCC chairman in a recess appointment to succeed the former chairman James Lawrence Fly. President Roosevelt had sent Mr. Porter's name to the Senate committee of the 78th Congress, but because of other pending legislation, the nomination was not put through. The Senate committee of the 79th Congress which convened on January 3, approved Mr. Porter's appointment.

As pointed out last month, it is expected that President Roosevelt will submit the name of one more member, to fill the FCC post left vacant by Commander T. A. M. Craven. Rosel H. Hyde, the assistant general counsel in charge of broadcasting, appears to be the favorite for this post at this writing.

Incidentally, newly elected Senator Homer Capehart, the former radio manufacturer, is now on the committee that considered the nomination of Paul A. Porter.

THE EAGERLY AWAITED FCC FREQUENCY ASSIGNMENT PLAN covering one portion of the spectrum, the high-frequency part, disclosed assignments for several new services and shifts in frequency for FM and television. The report, one of the most comprehensive ever prepared, explained in detail how each of the frequency assignments were made. Six factors guided the Commission in determining allocations. First the Commission examined each request to determine whether the service really required radio or whether wire lines could be used. Not only were technical considerations studied, but also economic and social factors as well as national policy conditions.

The second principle involved an evaluation of the services. In other words those radio services which were necessary for the safety of life and property deserved more consideration than convenience or luxury services. The third point which guided the Commission concerned the number of people who would benefit by this service, and in this respect large groups of

population were considered rather than small selected groups.

The fourth problem considered concerned new services and their usefulness to the community. Public acceptability was also a prime factor in this study. The place of the frequency in the spectrum was the fifth point studied by the Commission. It was necessary to determine what frequencies are best suited for long- and short-range communication, in what type localities these frequencies would be used, and by what forms of services they would be employed.

In the sixth and concluding factor analyzed competitive and economic aspects were considered; that is, the Commission had to consider the competing requests for two or more services in the same portion of the spectrum in one instance. It had to consider the number of transmitters and receivers in use, the investment of the industry and public in equipment, cost and feasibility of converting equipment for operation on different frequencies as well as time required for an orderly change to any newly assigned frequencies.

With the above format in mind, the Commission found it necessary, in some cases to shift frequencies. This was partciularly true with FM and television. FM, for instance, was assigned to the 84- to 102-megacycle band, in contrast to the 40- to 50-megacycle region proposal made by the RTPB and the FM industry in general. Ninety channels, 200 kilocycles wide, were included in this new assignment; twenty of these were proposed for noncommercial educational stations. The latter are scheduled to cover the 84- to 88-mc. band.

Several reasons were cited by the FCC for this shift, a shift incidentally that has not met with the approval of the FM industry. The FCC pointed out that it was necessary to give careful consideration to the propagation problems created by skyway interference of the "burst", "sporadic E", and the "F2 layer" types. They also said that attention had to be given to the problems created by "multipath distortion" and "shadows." The FCC disclosed that during deliberations of the RTPB Panel 5, some members recognized that skyway transmission of sufficient severity might jeopardize the very existence of FM as a broadcast service.

Testimony disclosed that it was possible that FM service would be washed out for as many as four or five hours of an evening, for three or four winter months and for as many as two, three, or four years at the time of the sun-spot maximum. Experts appearing at the RTPB hearings also stated that the sporadic E or F2 layer transmissions occurred with sufficient intensity and frequency in the 40- to 50-megacycle band to upset service. None of the industry witnesses offered quantitative data on this type of interference. However, Dr. L. P. Wheeler, chief of the FCC Technical Information Section presented a report disclosing that this interference was quite substantial during some times of the year.

Government testimony also presented by K. A. Norton of the Office of the Chief Signal Officer of the War Department at RTPB hearings showed that F2 layer transmissions at 44-mc. caused interference from a co-channel station 2,060 miles away for 723 hours in one sun-spot cycle. Commenting on this, the FCC report said . . . "this interference would be concentrated principally during two or three years of the sun-spot maximum and necessarily would be greater from stations farther apart . . . these computations of Mr. Norton were based on ionospheric measurements at Washington, D. C. and since the layer at Washington does not support as high frequencies as it does in other areas, the interference due to reflections outside of Washington may be greater. Moreover prolonged interference of this type could be expected from stations south of the United States."

Civilian experts, which included Jansky, Lodge, and Armstrong, testified that sporadic E- and F-layer transmissions would be less in the 100-megacycle regions than at 50 megacycles, the report indicated. And present experience, according to the FCC, supports the view that F-layer transmission would be negligible in the vicinity of 80 megacycles, and additionally sporadic E transmissions would be approximately 1/100th as prolonged at 80 megacycles as at 40. Therefore says the FCC, the virtual disappearance of skyway interference above 80 megacycles solves the chief propagation difficulties for FM and eliminates the principal obstacle toward the permanent establishment of a basic broadcast service.

Testimony offered at the hearings indicated that multipath distortion was not regarded as a difficulty which would seriously impair FM either in the present band or the suggested higher frequencies. As to "shadows" some did testify at the hearings that this effect was more pronounced at 100 mc. than at 50. Major Armstrong stated that the shadow area would diminish in ratio to the signal strength.

William Lodge of CBS indicated, on the other hand, that there would be very little change in the shadow problem with FM on the higher frequencies. The 200-kilocycle wide channel was selected to realize the full capabilities of FM to provide tone realism and suppression of noise, the FCC report stated. Such a wide channel, said the FCC, will discriminate against noise and other interference. During the hearings, both the 100-kc. and 200-kc. causes were defended. Major Armstrong pointed out in testimony that the 100-kc. channels might impose such receiver design problems as oscillator drift and instability. In addition, Major Armstrong also stated during the hearings that in the event

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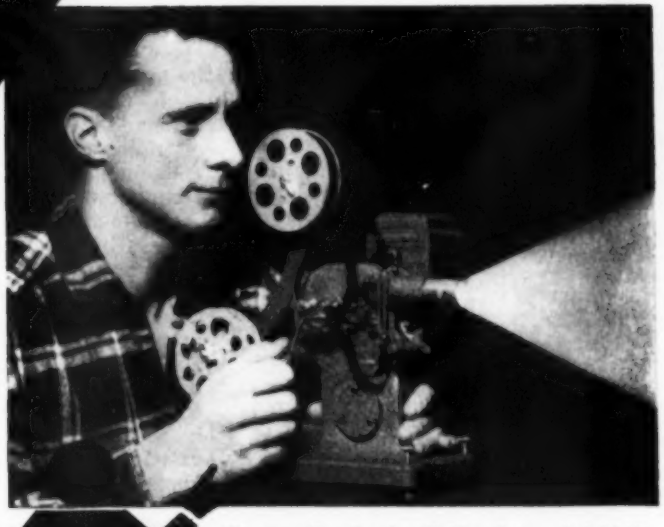

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that multiplexing of facsimile with FM should prove feasible, such multiplexing would be difficult if not impossible if a 100-kc. channel width were used.

Other factors considered by the Commission in establishing the new FM channel were nationwide coverage, market areas, and co-channel assignments. The Commission also stated that it would be impossible to authorize construction for the many who are interested in FM if the present 35-channel assignment was maintained. Thus far, 248 applications have been received, and more are coming in daily.

To obviate any hardship, the FCC stated that existing FM stations will not be required to move to new assignments until such times as new receivers were generally available and in the hands of the public. Then the Commission will assign a frequency in the 84- to 102-megacycle band to each existing licensee who will be expected, within a reasonable period of time, to make the necessary arrangements for operation on the new frequency.

Commenting on the 500,000 FM receivers in the hands of the public the FCC report said . . . "the cost to the public as the result of moving FM from its present band, will not be great. . . . The present receivers are, of course, several years old. Even if the present FM band were retained, these receivers would become partially obsolete since an expansion of the existing 42- to 52-mc. band would place a number of stations out of range. In some cases, old FM receivers can be converted for reception on the higher frequencies. Moreover present AM receivers can include FM attachments which will not be appreciably more costly in the 84- to 102-megacycle band than in the present band."

Inquiry among many receiver engineers disclosed that converters were practical for conversion and might cost anywhere from $25 to $100. Some engineers stated that such conversion might introduce instability and alignment problems. Some manufacturers pointed out that their receivers already had extended range tuning characteristics, while others stated that their receivers could be redesigned to accommodate the extended tuning range.

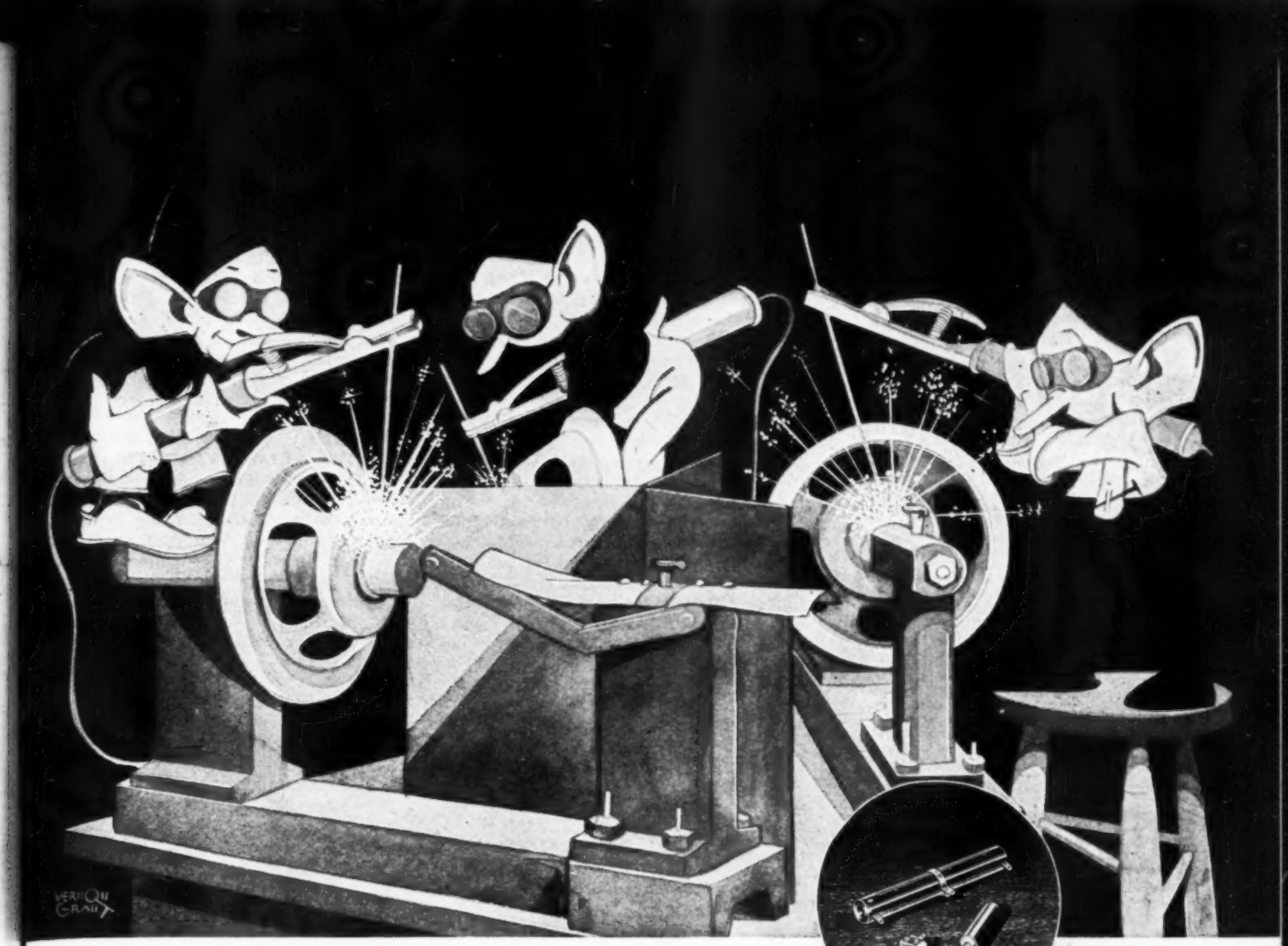
Since the present allocation plan is but a proposal, no definite action is being taken as yet by receiving engineers. However, should the program be adopted, engineers have indicated that a concerted effort to solve the problem will of course be pursued. (Authoritative sources have indicated that the proposed FM assignments can be considered as permanent and final.)

THE TELEVISION SPECTRUM WAS SHUFFLED AROUND A BIT, TOO, in the FCC frequency proposal. The new assignment plan calls for 6 channels between 44 and 84 megacycles and 6 channels between 180 and 216 megacycles. These 12 channels are broken down as follows: *1*—44-50-mc.; *2*—54-60 mc.; *3*—60-66 mc.; *4*—66-72 mc.; *5*—72-78 mc. (aviation markers on 75 mc. will probably be removed before this frequency is available for television); *6*—78-84 mc.; *7*—180-186 mc.; *8*—186-192 mc.; *9*—192-198 mc.; *10*—198-204 mc.; *11*—204-210 mc; and *12*—212-216 mc. (channel 7 through 12 will be temporarily available for relay purposes). The FCC pointed out in their report that television has been allocated the same number of channels, 12, below 225 mc. as previously. However, due to demands of other services, it was not possible to provide any additional channels below 225. The old television channel 7, 102-108 mc. was left unassigned at this time.

The Commission indicated, however, that it will give due consideration to this channel. Manufacturers were asked to include this band on their receivers. In addition to these channels, the FCC also provided for the spectrum between 480 and 920 mc. for experimental television. The 1225- to 1325-mc. band was assigned for television relay to be used by pickup stations for relaying programs. No channel-width requirements were indicated at the higher frequencies because at this time the FCC said no equipment has been made available to provide sufficient accurate information.

Commenting on skywave interference, the FCC report stated that this may be a problem in the lower-frequency channels. However, said the report, it was impossible to find 12 television channels between that part of the spectrum which is free of skywave interference and 225 megacycles, because of other service demands. The report then went on to say that should this skywave interference develop, the 6 channels above 180 megacycles offer a possible means for alleviating this interference, in that these channels in time can be employed for higher-powered stations and the lower-frequency channels reserved for stations that will use limited power.

To encourage development of higher definition pictures and color transmission, the 480- to 920-mc. band was set aside. The FCC believes that these high frequencies offer great opportunities. They say . . . "It is the hope of the Commission that all persons interested in the future of television will undertake comprehensive and adequate experimentation in the upper portion of the spectrum. The importance of an adequate program of experimentation in this portion of the spectrum cannot be overemphasized for it is obvious in the allocations which the Commission is making for television below 300 megacycles that in the present state of the art the development of the upper portion of the spectrum is necessary for the establishment of a truly nationwide and competitive television system."



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The FCC proposal carries less channels than the RTPB requested. They requested 18. The Commission however feels that 12 are the maximum which can be assigned to television below 300 mc. at the present time.

AMATEURS RECEIVED TEN ASSIGNMENTS in the new FCC allocation proposal. These were: 28-30 mc.; 50-54 mc.; 144-148 mc.; 220-225 mc.; 420-450 mc.; 1125-1225 mc.; 2500-2700 mc.; 5200-5750 mc.; 10,000-10,500 mc.; and 21,000-22,000 mc.

There have been several shifts in the "ham" bands. For instance the 56-60-mc. band was shifted to 50-54 to permit television channel 2 to fall between 54 and 60 megacycles. The FCC stated that they believed that this shift will not interfere with amateur operations and will be of tremendous aid to television.

The 112-116-megacycle band, which was formerly allocated to "ham" service is now being used by the aeronautical industry and will continue to be used by the aeronautical people for navigational activities. The 4-megacycle band deleted from the "ham" service in this portion of the spectrum was restored at the higher frequencies of 144-148 megacycles. The 224-230-megacycle band, also formerly assigned to "ham" service, had to be shifted because of demands for the 225-420-megacycle band by the government radio services for fixed mobile operation. In its place the FCC allowed the "hams" to have 220-225 megacycles. The ARRL requested a 32-megacycle band from 448 to 480. However, because of the use of this band for special air navigation aids, the FCC provided a 30-megacycle band between 420 and 450. This proposed allocation provides for sharing of the band by the air navigation people and low-power "ham" services. FCC officials indicated that ultimately the "hams" will have this frequency to themselves.

"Hams" also requested the 896-960-megacycle and 1792-1920-megacycle bands. Readjustments in these assignments had to be made again because of government requirements, as well as experimental service needs. For instance the 896-960 band happened to fall in the band allocated to experimental broadcast services while the 1792-1920-megacycle band fell in the government band. The FCC compromised by providing a 100-megacycle channel between 1125 and 1225 megacyles. Another band which the amateurs requested was a 3584 to 3840 megacycles. Again navigational aids interfered and instead the FCC assigned the 2500-2700-megacycle band.

Other frequencies which "hams" requested were 7168-7680 mc. and 14,336-15,360. In the first instance, government and mobile services had been allocated these frequencies and therefore the FCC provided a lower band between 5200 and 5750 mc. And instead of the 14,336-megacycle band, which was also another exclusive government allocation, amateurs were given a 500-megacycle band between 10,000 and 10,500. The ultra-high frequencies of 28,672 and 30,720 megacycles were also asked for by amateurs. Since this frequency extended beyond the limits of the spectrum for which allocations were being made, the amateurs received a 1000-megacycle band between 21,000 and 22,000 megacycles. The area above 30,000 megacycles was designed as experimental and will provide for experimentation by "hams."

PROBABLY THE MOST UNIQUE OF THE ALLOCATIONS IN THE FCC PROPOSAL was the 460-470 megacycle assignment to a new service known as "citizens radio communications service." This new band was assigned on the Commission's own motion in view of the successful development of portable short-range equipment of the walkie-talkie type on the battlefront. The FCC indicated that this new service will offer uses that are as broad as the imagination of the public and the ingenuity of equipment manufacturers can devise.

Describing the applications of this short-range communications system, the FCC stated that it can be used on farms and ranches for communications to and from men in the fields and on board harbor and river craft. They also said that sportsmen and explorers could use it to maintain contact with camps and thus decrease the hazards of hunting, fishing, boating, and mountain climbing. They even pointed out that the system can be applied to a physician's calling service whereby a central physician's exchange in each city can reach doctors while they are enroute in their cars, or otherwise not available by telephone.

Department stores, dairies, and laundries are other types of services that could use the walkie-talkie system in communicating to and from delivery vehicles, said the FCC. It also can be used for communicating to and from trucks, tractors, and mobile units, stated FCC officials. The system will also be invaluable during emergencies when wire facilities are disrupted as a result of hurricane, flood, or earthquakes.

So that everyone will be able to use this service, the FCC proposed an extremely simplified license-procuring procedure. It will only be necessary to show familiarity with the relevant portions of the Communications Act and of the simple regulations governing this service. No technical knowledge will be required nor will any examination be given. Only citizens of the United States will receive these license grants which, incidentally, will probably be in force for five years. The licenses will cover point-to-point, fixed point-to-mobile, mobile-to-mobile, and multiple-address communications. There will be no charge made for the transmission of messages and

(*Continued on page* 94)

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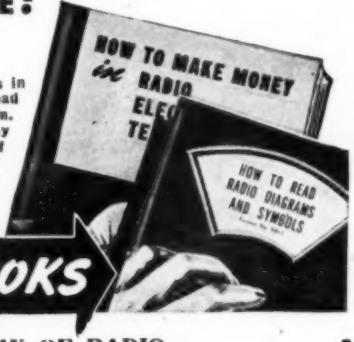

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SPECIFICATIONS OF THE MODEL 205-S

OUTPUT LEVEL: Power rating: 27 db below 6 milliwatts for 10 bar pressure. **Voltage rating:** 10 db above .001 volt/bar, open circuit. Voltage developed by normal speech (100 bars); .32 volt.
FREQUENCY RESPONSE: substantially flat from 100-4000 c.p.s.
ARTICULATION: at least 97% articulation under quiet conditions; 88% under 115 db of ambient noise.
AVERAGE BACKGROUND NOISE REDUCTION: 20 db and higher, depending on distance from noise source.
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INPUT: standard single button input is required.
CURRENT: 10-50 milliampere button current.
HOUSING: molded, high impact phenolic housing; minimum wall thickness, 5/32", vinylite carbon retainer.
TEMPERATURE RANGE: from —40° to +185°F.
PRESS-TO-TALK SWITCH: available with or without hold-down lock. Double pole double throw contacts provide an optional wide assortment of switch circuits.
STANDARD SWITCH CIRCUIT: provides closing of button circuit and relay simultaneously.
THERMAL NOISE: less than 1 millivolt with 50 milliamperes through button.
STURDY CONSTRUCTION: capable of withstanding impact of more than 10,000 6" drops to hard surface.
POSITIONAL RESPONSE: plus or minus of 5 db of horizontal.
CONDUCTOR CABLE: 5 feet of two conductor and shielded cable. overall synthetic rubber jacketed.

Model 205-S,
List Price..**$25.00**

Model 205-SL,
with switch lock,
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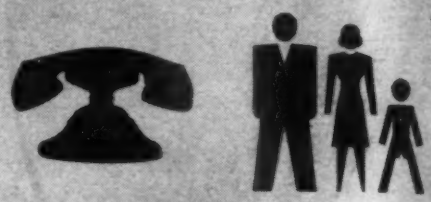
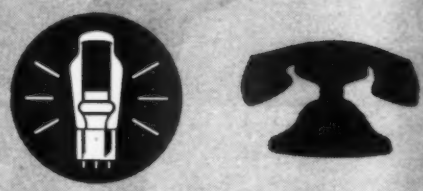


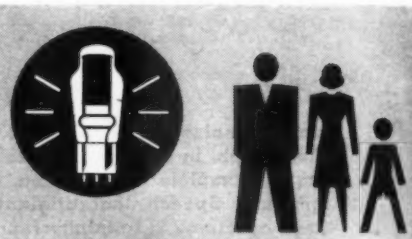
MINOR PREMISE:

Bell Telephone Laboratories develop the facilities of the Bell System.



CONCLUSION:

Therefore, Bell Laboratories serve the American Public.

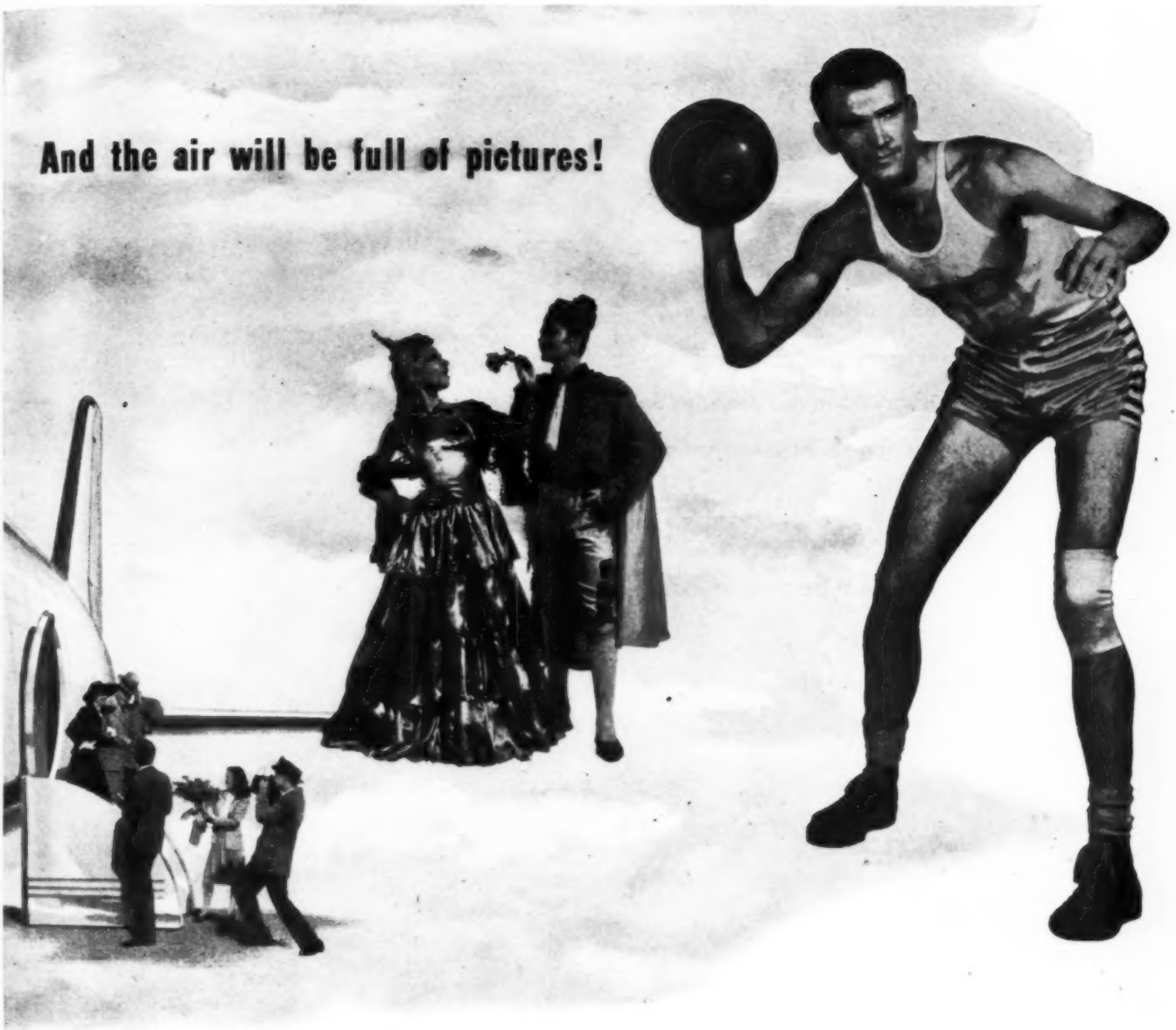


And that is the *raison d'être* of the Laboratories. For the Bell Telephone System, the Laboratories carry on research studies in all the sciences and development work in all the engineering arts that relate to electrical communication.

For the Western Electric Company, the manufacturing unit of the System, the Laboratories develop equipment, prepare specifications for its construction, and engage in various engineering activities.

For the Armed Forces of the United States, under contracts of the Western Electric, the Laboratories have undertaken more than a thousand development projects — many with spectacular effect upon our enemies.

BELL TELEPHONE LABORATORIES ***explore and invent, devise and perfect for our Armed Forces at war and for continued improvements and economies in telephone service.***



Just as your radio captures music and drama and news from the air, so your television receiving set will snatch from space *the sight as well as the sound* of the programs you tune in — *while they are taking place miles away!*

You can expect many exciting things — in radios, in phonograph-radios, and in television — from the engineers who develop Capehart and Farnsworth instruments. Their experience enabled them — almost overnight — to turn the Farnsworth plants to production of Radar, military radios for planes, ships and land forces, and other communications equipment for Allied fighters.

Out of this unique background, after the war, will come new Capeharts and new Farnsworth radios and phonograph-radios with reception and tone and fidelity that will amaze you.

You will choose from a rich selection of Farnsworth and Capehart instruments . . . sizes and styles in great variety, and at a wide range of prices . . . both standard broadcast and the new FM radio, dependable record-changers, and eventually the magic of television (reward of 19 years of Farnsworth research and development), in models from the most modestly priced to the most luxurious.

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THE PIANO OF THE *Future*

By Stanley Kempner

The Dynatone—a versatile musical instrument, combining an electronic piano with radio and phonograph reproduction.

BACK in 1710, the standard piano as known today was first invented. For over two hundred years it remained substantially unchanged. Designers and technicians responsible for piano structure had long realized certain limitations in this instrument which they struggled to overcome. Fundamental among these limitations is the fact that the tone and volume, especially on the lower notes, is dependent on the mechanical energy produced by the vibrating strings.

Attempts to overcome this led to the use of longer strings and higher tensions coupled to still larger sounding boards and finally culminating in the modern concert-grand piano with a nine and one-half foot depth and enormous weight. Cost of this latter piano was beyond the pocketbooks of many music lovers and professionals. The size was too tremendous and constituted a special problem for the average home-owner or apartment-house dweller.

With electrical amplification came the realization to piano engineers that new and improved instruments might be evolved and constructed.

Early attempts to amplify the tone of the piano were based on the telephone repeater amplifiers even before the advent of the electronic tube and these were of no more than passing interest because of the limitations of this type of amplification. The coming of electronic tubes and the development of the amplifiers associated with them opened up tremendous new possibilities which were barely explored before the war. Credit for much of the pioneering is due to John Hays Hammond, Jr., and Benjamin F. Miessner, both inventors and engineers, whose developments are being used in many of the modern electronic musical instruments.

One of the most promising was the application of the electrical pickup of one kind or another to the vibrating strings of the piano. This eliminated the necessity of the long strings, high tension, and the large sounding boards formerly required and removed the limitations of tone that had made small pianos unsatisfactory to the critical appreciatists of piano music.

The pianist has the privilege of adjusting the volume level and character of tone by means of simple controls, an advantage that the standard piano cannot offer.

Electronic musical instruments seem certain to play an important part among the postwar uses of the science of electronics. Along with the newly developed wonders of this age, which include television, frequency modulation, facsimile, radar, and other electronic discoveries, is the introduction of a piano without a sounding board, but with a radio and phonograph installed in its vitals, and all three using the same electronic amplifier and speaker.

This three-dimensional musical instrument, described as the "piano of

The phono motor and pickup are placed in a drawer-like compartment on the left of the instrument, while all Dynatone and radio controls are placed on the right.

the future," is the *Dynatone*. It is the brainchild of Arthur C. Ansley, a New York radio engineer and manufacturer.

This instrument has been designed as a complete center for the musical life of the home, for it unites a versatile combination for the creation of music, with radio, records, and microphone reproduction.

Enclosed in a spinet-type piano cabinet, it is only three feet high, two feet deep, and four and one-half feet wide, and has amazing flexibility.

According to a prominent piano executive, the Dynatone is so well engineered that it cannot be told from the standard type, yet it has all the possibilities of tone inherent in the electronic type. One virtue of electronic amplification is reinforcement of the bass tone, which generally has been a troublesome problem in regular pianos.

On the other hand, it can be played well into the night without disturbing the people in the next apartment because of the absence of the soundboard if the amplification is not used. The quality of the tone is said to be more bell-like than that of the best piano and of longer duration when amplified.

It plays like a piano, a harpsichord, or a concert grand, depending upon the press of a lever. The inventor protests that it is not a piano though the tone is produced by a piano action playing strings. But it is difficult to place it in any other existing category.

There is nothing unusual about playing the Dynatone. The pianist simply has the privilege of adjusting the general volume level and character of tone by means of the controls provided, an advantage the earlier or acoustical piano cannot offer. The keyboard and action are standard in every way, correct in scale, compass and position, normal in "touch" and operation.

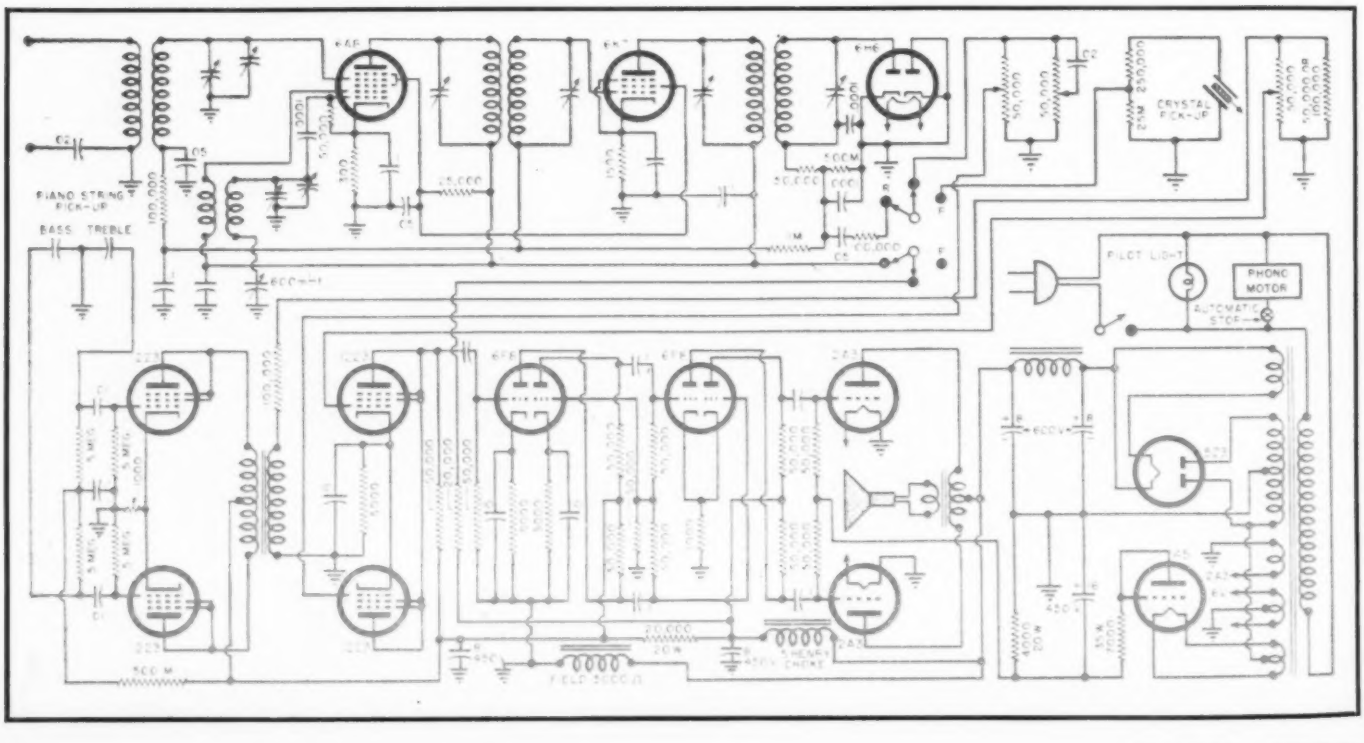
The pedals are the regular soft pedal and sustaining or "loud" pedal of the piano, having the usual functions and in the correct location. An added pedal, similar in some ways to the "swell" pedal of the organ, is provided to take advantage of some of the flexibility that is characteristic of electrically amplified instruments. The operation of this pedal is described in more detail later.

The high-fidelity radio and phonograph are neatly and invisibly encased on either side. On the left, below the bass, is a drawer in which the phonograph is concealed. On the right, is a panel which, when opened, reveals the radio controls. Nothing has to be done with the controls while playing. The volume is set where the pianist wants it for the room or purpose, and never touched unless these change. The range is very wide, indeed, both in color and power. Electronic musical instruments all consist basically of a means for generating musical tones, a vacuum-tube amplifier for increasing their volume, and a reproducer or loudspeaker for making the tones audible.

The means of generating the tone vary in different types of instruments. Vacuum-tube oscillators are sometimes used. Other instruments use rotary generators of various types while some use vibrating reeds or strings.

The Dynatone uses vibrating strings actuated by a standard piano action with a full keyboard. While the ordi-

Diagram of the electronic equipment employed in the Dynatone. Vibrating strings actuated by standard piano action are used.



nary piano depends on the power of the string itself to drive a wooden sounding board and increase the intensity of the sound, the "piano of the future" uses no sounding board but picks the tone up electrically from this vibrating string and amplifies it electronically. In this way, shorter strings under lower tension serve the same purpose and give the same full tone and volume as the long, highly tensioned strings of the large grand piano.

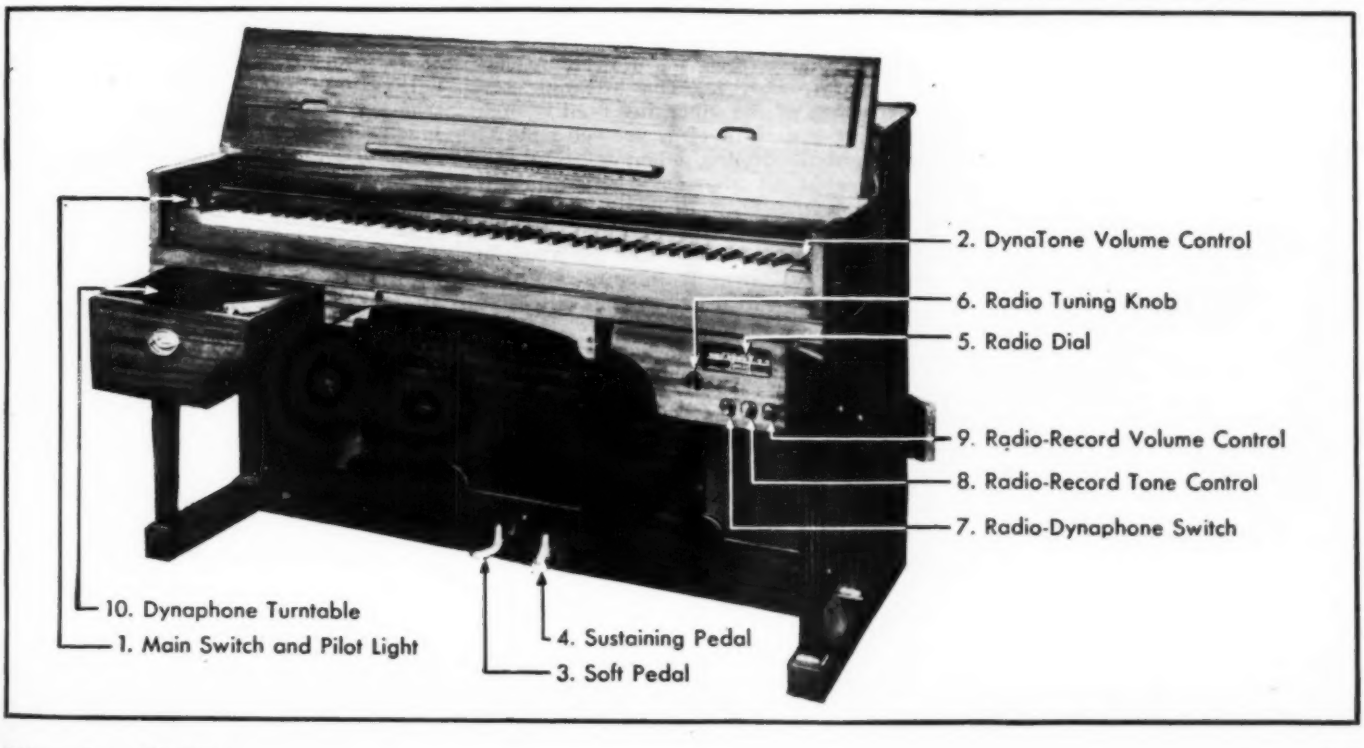
At the same time the electric amplifier serves as a high-quality medium for use with the radio tuner, the record player, and the microphone. The most interesting part of this instrument to a radio technician, is the method of generating and amplifying the tones. The principle of the condenser microphone is well known. The same principle is used here except that the strings of each of the 88 notes form one plate of a small condenser and a pickup button of brass with a flat head, in close proximity to the string but not touching it, forms the other plate. A d.c. voltage of about 150 volts is impressed across the plates of this condenser with a resistance of 5 megohms in series with it.

When the string is struck by the hammer of the piano action, it vibrates and this changes the capacity of the little pickup condenser. The charging and discharging of the tiny condenser causes a minute fluctuating current to flow through the 5-megohm series resistance which is an exact replica of the string vibration. It is the voltage drop across this resistance that is fed into the input of the high-gain amplifier.

(*Continued on page* 106)

This instrument employs a spinet-type piano cabinet. The pilot light glows as long as the power is turned on. When practicing softly or when only the harpsichord effect is desired, the power can be turned off.

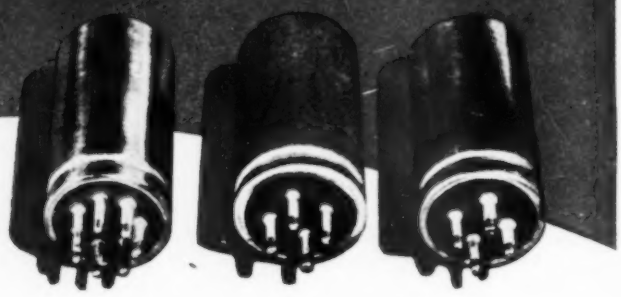
The volume control (No. 2), when turned all the way to the left, reduces amplification and a harpsichord quality is thereby obtained by the impact of the hammers on the strings. Turned towards the right, piano quality is introduced, increasing in volume to whatever degree desired. This control should be turned off when the Dynaphone or radio is in use.

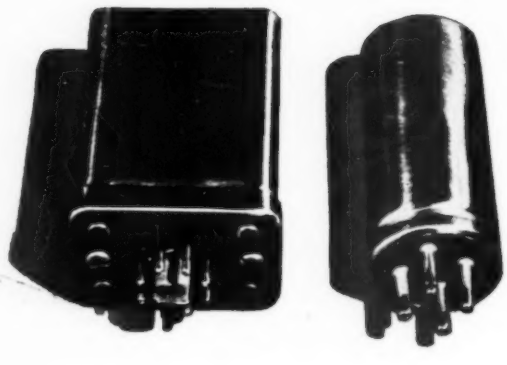


SERVICING AUTO RADIOS

By MILTON S. KIVER

The vibrator, being the heart of all auto receivers, is also the most possible cause of trouble. This article presents the troubles that can occur and methods for their solution.





Various forms of vibrator assemblies. The unit in upper center has a serrated can to increase its radiating surface, reducing temperature of internal mechanism.

TROUBLES that radio servicemen may find in automobile receivers can be classified into two categories. In one category we find the ordinary troubles similar in all respects to those found in electric home receivers. In the other division we have those repairs peculiar only to automobile sets. It is with the latter that we are here concerned.

In dealing with these additional troubles it will prove helpful if their possible points or origin are itemized and analyzed as follows:

1. The power supply.
2. The shielding of components.
3. Effects of the vibration of the car.
4. The car, exclusive of the radio set.
5. The antenna.

Each of the above divisions will be dealt with separately. It is only through a thorough understanding of the effects of these various components that the radio serviceman can accomplish his job quickly and efficiently.

The Power Supply

Exclusive of a few models using motor-generator units as the source of supply, most of the auto radio sets employ vibrator power supplies. Here the six-volt car battery is connected to a vibrator unit which alternately interrupts the flow of current from the battery. It is through this rapid rate of vibrations that the pulsating primary current is able to induce large alternating voltages across the secondary of a power transformer. This large a.c. voltage is then converted to d.c. by one of two methods and applied to the radio set proper.

There are three general types of vibrators that are found in radio sets for automobiles. One is the half-wave interrupter, another is a full-wave interrupter and the third is a self-rectifying synchronous vibrator. Of the three, most radio manufacturers seem to prefer the second one. This is probably due to the fact that its output requires less filtering than the half-wave vibrator and it generates less "hash" (r.f. interference) than the synchronous vibrator. However, since servicemen are called upon to repair sets that may contain any of these, the operating principles of all three will be given.

For half-wave vibrators, the complete process can be followed by reference to Fig. 4. The internal construction of the vibrating reed is such as to normally keep it pressed against contact *A*. Hence, when a battery is connected as shown, a current will flow in the path BCAD. This same current, flowing through the electromagnetic coil, will cause the reed to be attracted away from contact *A*, and this action will break the circuit. The instant this happens, the reed is no longer held by the electromagnetic coil and it swings back to position *A*. With a complete circuit formed again, the cycle now repeats itself. The frequency at which these vibrations take place is generally near 85 cycles-per-second.

The pulsating current, passing through the primary of T_1 will induce an a.c. voltage in the secondary. Then a rectifier, either a cold-cathode gaseous type (OZ4) or a vacuum tube (6X5) converts the voltage to d.c. The ordinary filter circuit then completes the rectification. The amount of voltage induced in the secondary will depend on the number of turns here and on the rate at which the pulsations take place.

A full-wave vibrator is illustrated in Fig. 2. The position of the vibrating reed shown is the normal position. Connecting a battery to the points indicated will cause a current flow through the path ABCEDF. Notice that with the reed in its rest position, no current can flow through either of the contact points G and H. The current, in passing through the coil L, will set up a magnetic field and by attraction, cause the reed to move toward the left. The reed now makes contact with point H and the coil L is automatically short-circuited. The solid arrow indicates the flow of current through the primary of T_1.

With L cut-out, there is nothing to hold the reed in its present position and it swings back, past its center rest position, and on to contact G. Contact here completes the path ABGF and current now flows through the transformer T_1 in the direction indicated by the dashed arrow. At the same time, current can also flow again through the magnetic coil L and this acts to attract the reed back toward contact H. The resulting rapid vibrations break up the direct current from the battery into a series of pulses and these currents induce large a.c. voltages in the secondary of T_1. Here, as shown, rectification takes place in the usual manner.

The operation of the third and final unit, the synchronous rectifying vibra-

tor is illustrated in Fig. 3. For this vibrator, the primary and secondary of the power transformer are so connected to the vibrator contacts that the resulting flow of current in the "B+" filter chokes is always in one direction. This condition, then, allows us to eliminate the rectifying tube which is ordinarily used for this same purpose.

To start, assume that the vibrating reed is midway between points A and C in Fig. 3A. A current will then flow in the path shown by the arrows. This will take the current through the lower portion of the primary of the transformer, to the vibrator coil L, and then back to the battery. There is no other path possible just yet. The magnetic field set up by the coil L attracts the reed and forces it to move toward contacts C and D.

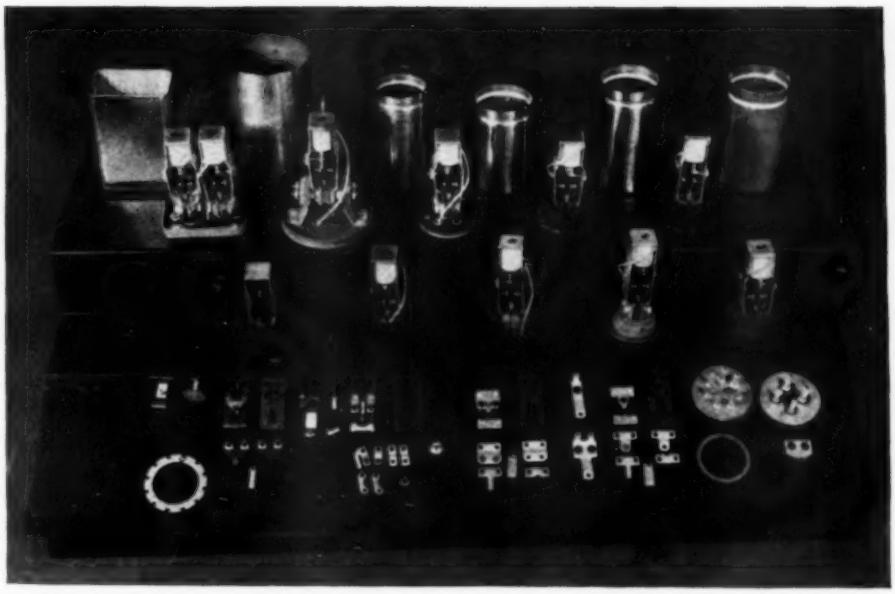
When contact is made, C and D are both connected to ground through the reed. Current can now flow through the lower primary of T_1 and then back to the battery. The vibrator coil L is shorted with the reed in its present position and can no longer attract the reed. For a fraction of a second, before the reed tries to return to its rest position, there is a surge of current through the primary of T_1 and this induces a voltage in the secondary of T_1 with the polarity indicated. As is usual, the voltage induced in the secondary is opposite in polarity to the primary voltage.

In the same instant, just before the reed swings away, contact D is also connected to ground. This completes the secondary circuit so that there the induced voltage will cause current to flow from the secondary, through the filter chokes, through the load to ground and from there through contact D back to the secondary winding again. The upper portion of the secondary does not form part of a complete circuit and so any induced voltage within it cannot act.

Now let us consider the second half of this process, when the vibrating reed has left contacts C and D and swung to contacts A and B. Current from the battery can now flow through the upper half of the primary of T_1, through contact A and back to the battery. This flow will cause a voltage to be induced in the secondary windings. The induced voltage, though, will now be in the opposite direction because the flow of current in the primary is in the opposite direction. This is shown in Fig. 3B.

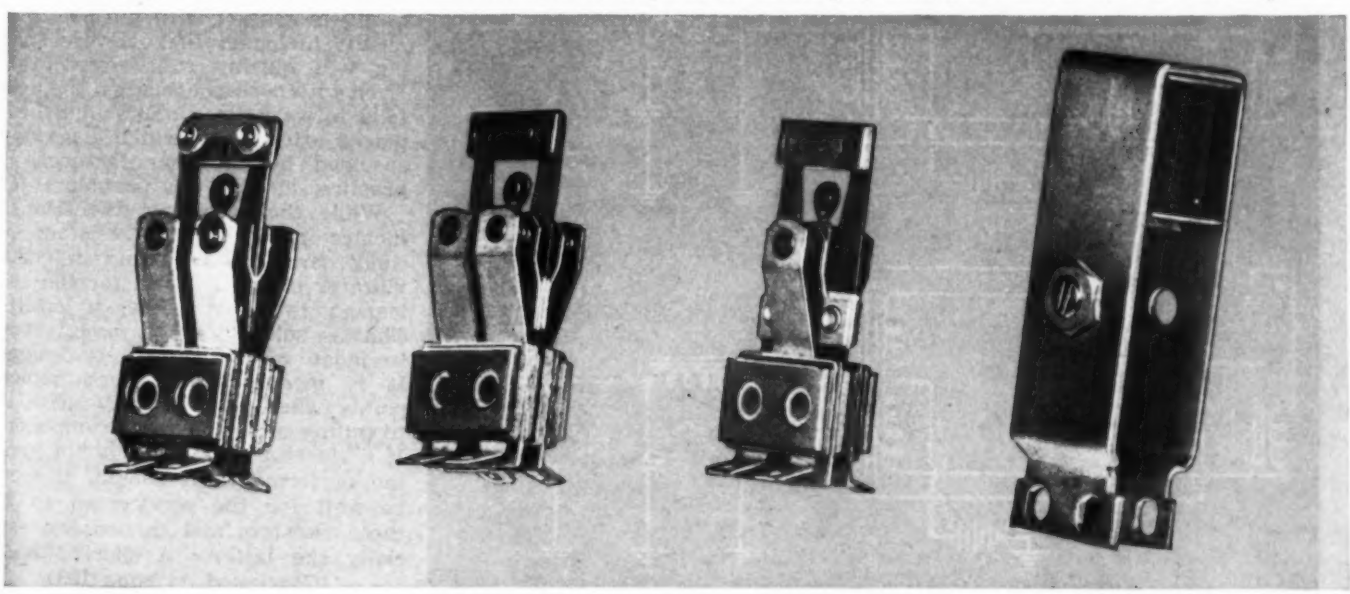
Due to contact *B*, only the voltage in the upper half of the secondary of T_1 will cause current to flow in a complete path. If traced out, it will be easily seen that the current once again flows through the filter chokes in the same direction as before. Thus, it can be seen that the vibrating reed automatically chooses the correct circuit so that the current, in the secondary, flows in only one direction. The reed is brought back to the lower set of contacts by the vibrator coil *L*. This has current flow in it the instant the reed leaves the lower set of contacts.

There is one point of caution that must be observed when inserting synchronous vibrators into auto radio sets. This refers to the polarity of the automobile storage battery. In some sets the positive is grounded, while in others the negative is the one put at ground potential. The synchronous vibrator will work only with one type of connection, depending on how it was originally designed. To make this point clear, Fig. 3A will be used. In this diagram, as it is shown, the negative side of the battery is connected to the car ground terminal. Then current will flow as



A display of vibrators and their components. In the upper left-hand corner is shown a double-vibrator assembly, used in an aircraft application. The vibrator mounted directly to its right is a 19-cycle rigidly-mounted unit used in field telephone equipment. In the foreground are various parts, such as reeds, terminals, spacers, bases, contacts, etc., used to make up the vibrator.

Various types of vibrator stacked assemblies; (left to right) split reed, self-rectifying, interrupter, and coil and frame assembly.



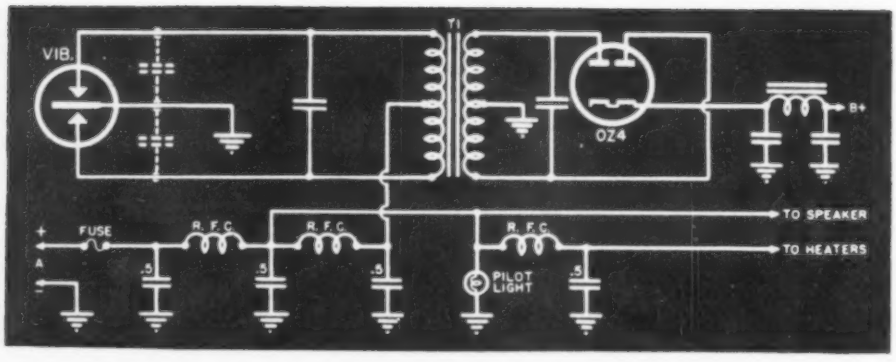


Fig. 1. Diagram showing complete filtering system for an auto radio power unit.

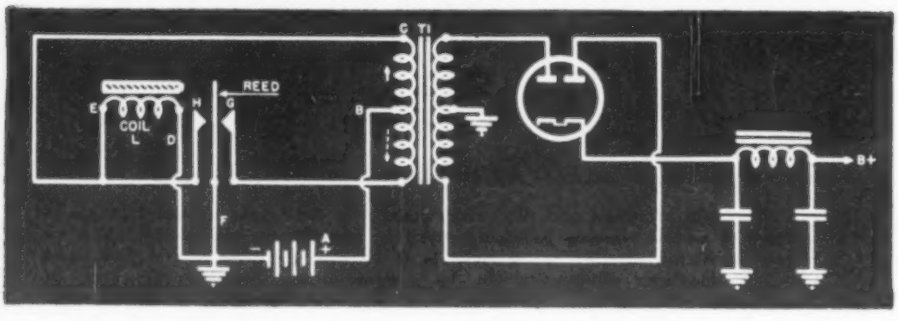


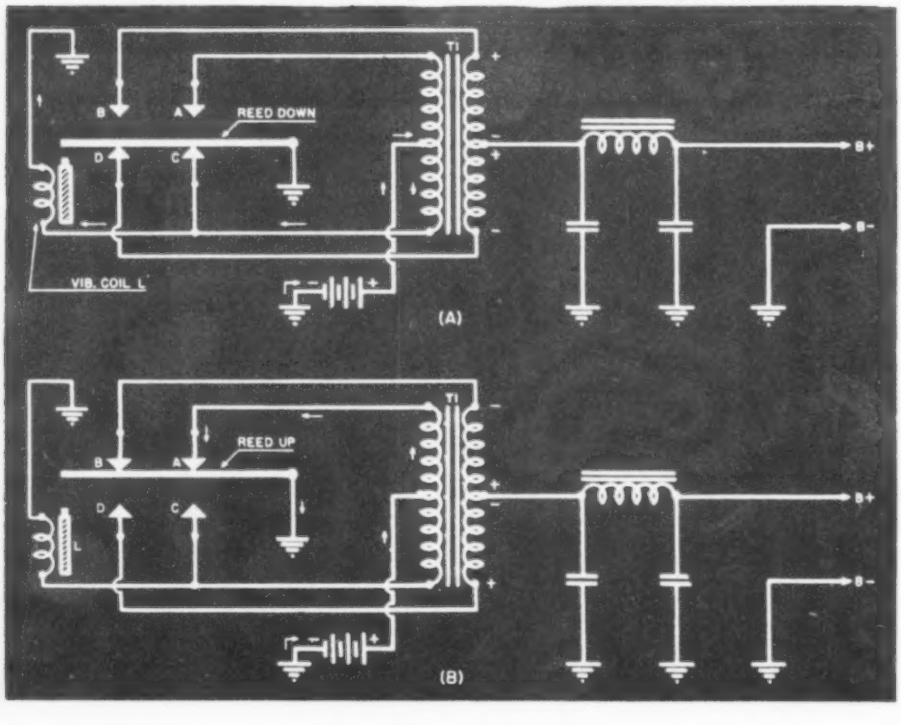
Fig. 2. A full-wave vibrator unit. The vibrations of the reed between contacts G and H cause large a.c. voltages to appear across the rectifier tube.

indicated and the secondary voltage will develop and operate according to the above explanation. So far so good.

But now suppose that the "A+" lead were connected opposite to the above, that is, to the ground terminal of the car. Then it stands to reason, that while the vibrating reed goes through the same motions as before, the voltage induced in the secondary will be opposite to that shown in Fig. 3A. This will mean that the electrolytic condensers in the "B+" filter section will act as shorts and no direct current voltage will be developed. Probably the vibrator unit will have an excess current through it and will be ruined.

The only solution to this problem is to reverse the transformer leads either between contacts *B* and *D* or *A* and *C*. This can be done directly on the vibrator socket. It is therefore important that the serviceman satisfy himself completely before installing these self-rectifying synchronous vibrators. The above precautionary measure is probably also responsible for the discontinuance of this type of vibrator by many manufacturers.

Fig. 3. Diagram used to illustrate the electrical functions of a vibrator unit. (A) The first action in the operation of a synchronous vibrator. (B) The second half of the process, completing a full cycle. Arrows indicate primary current flow.



The above represents only the basic details in the operation of vibrator units. There are, in addition, other components that must be added before complete satisfactory operation can be attained. Foremost in importance is the buffer condenser usually connected across the secondary of the power transformer, T_1. This condenser is needed to protect the transformer and vibrator during the time that the vibrating reed is moving between contacts or sets of contacts. During this interval the circuit is open and a large back e.m.f. is induced across the transformer. The condenser absorbs this charge during the interval and discharges through the transformer windings when the reed makes contact and current flows in the primary. The value of this condenser is very critical and manufacturer's specifications should be followed when replacements are effected. Too low or too high a value will generally distort the output waveform and result in interference known as vibrator "hash."

Since the back e.m.f. voltages induced across the transformer may rise to high values, the buffer condensers used are generally of the small, oil-filled type, rated at 1600 volts or higher. Instead of just using one condenser across the entire secondary, two condensers with lower voltage ratings may be connected in series, both grounded at their point of connection. Fig. 5, A and B, shows both methods. In Fig. 5C is still another method employing a resistance in series with the condenser.

In addition to the buffer condenser just described, it is often found helpful if small condensers are placed across the primary of T_1 or even across the vibrator points. These generally result in less sparking at the vibrator when the reed is not actually in contact with the points and results in longer life. Severe sparking will quickly ruin any vibrator. Even with normal operation the points tend to wear away and should be replaced after the useful life period as specified by the manufacturer. In practice, though, this is seldom done.

While the preceding discussion indicates points where resistors and condensers may be found in certain vibrator units, it is not for the serviceman to insert these, if omitted. That is solely for the manufacturer to judge when the unit is designed. It is meant, however, to indicate points where trouble may arise due to failure of any of these components. If a vibrator power unit is not giving the performance it should, it would be well for the serviceman to test these resistors and condensers, especially the latter. A shorted buffer

(*Continued on page* 125)

PROPOSED FREQUENCY ALLOCATIONS

25,000 Kc. to 30,000,000 Kc.

A listing of the new allocations proposed by the Federal Communications Commission. (See complete analysis reported in Spot Radio News, p. 12.)

FREQ. BAND IN MC.	TYPE OF SERVICE
25.015-27.305	Govt. and Non-Govt., Fixed and Mobile
27.305-27.335	Scientific, Industrial and Medical
27.335-28	Govt. and Non-Govt., Fixed and Mobile
28-30	Amateur
30-30.5	Govt.
30.5-32	Non-Govt., Fixed and Mobile [2]
32-33	Govt.
33-34	Non-Govt., Fixed and Mobile [2]
34-35	Govt.
35-36	Non-Govt., Fixed and Mobile [2]
36-37	Govt.
37-38	Non-Govt., Fixed and Mobile [2]
38-39	Govt.
39-40	Non-Govt., Fixed and Mobile [2]
40-40.96	Govt.
40.96-41	Scientific, Industrial and Medical
41-42	Govt.
42-44	Non-Govt., Fixed and Mobile [3]
44-50	Television Broadcasting [4]
50-54	Amateur
54-78	Television, Fixed and Mobile [4]
78-84	Television Broadcasting
84-88	Educational FM Broadcasting
88-102	Commercial FM Broadcasting
102-108	To Be Determined Later [5]
108-118	Govt.
118-122	Airport Control
122-132	Aero Mobile (primarily Non-Govt.)
132-144	Govt.
144-148	Amateur
148-152	Govt.
152-156	Police [6]
156-162	Non-Govt., Fixed and Mobile [7]
162-170	Govt.
170-180	Navigation Aids
180-192	Television and Govt.
192-216	Television, Fixed and Mobile [4]
216-220	Govt.
220-225	Amateur
225-400	Govt. (75 Aero channels for Non-Govt.)
400-420	Govt.
420-450	Amateur and Air Navigation [8]
450-470	Non-Govt., Fixed and Mobile [9]
470-480	Facsimile Broadcasting
480-920	Television [10]
920-940	Experimental Broadcasting Services
940-960	Fixed and Experimental Broadcasting [11]
960-1125	Navigational Aids
1125-1225	Amateur
1225-1325	Television Relay
1325-1450	Govt.
1450-1500	Air Navigation Aids
1500-1550	Meteorological
1550-1650	Aeronautical Mobile
1650-1900	Govt.
1900-2300	Non-Govt., Fixed and Mobile
2300-2500	Air Navigation
2500-2700	Amateur
2700-2800	Meteorological
2800-3900	Navigation Aids
3900-4550	Non-Govt., Fixed and Mobile
4550-5200	Govt.
5200-5750	Amateur
5750-7050	Non-Govt., Fixed and Mobile
7050-10000	Govt.
10000-10500	Amateur
10500-13000	Non-Govt., Fixed and Mobile
13000-16000	Govt.
16000-18000	Non-Govt., Fixed and Mobile
18000-21000	Govt.
21000-22000	Amateur
22000-26000	Govt.
26000-30000	Non-Govt., Fixed and Mobile
30000-Up	Experimental

FOOTNOTES

[1] Channels in the 25 to 28 mc. band are tentatively distributed as follows: Provisional Motion Picture, Relay Press, Relay Broadcast, Geophysical, 22 channels; Power, Petroleum and Other, 5 channels; General Experimental, 10 channels.

[2] Assuming an average channel width of 40 kc., the minimum provisions in the band from 30 to 42 mc. will be distributed as follows: Police, 35 channels; Fire, 15 channels; Urban transit, Forestry and Conservation, 10 channels; Power, Petroleum, and Other, 10 channels; Special Emergency, 4 channels; Forestry and Conservation (10 channels to be shared with Urban Transit), 33 channels; Maritime Mobile, Geophysical, 9 channels; General Highway, Mobile (experimental) and Marine, 12 channels; General Experimental, 8 channels.

[3] Assuming an average channel width of 40 kc., the minimum provisions in the band from 42 to 44 mc. band will be distributed as follows: Police, 21 channels; General Highway, Mobile (experimental) and Marine, 12 channels; General Experimental, 11 channels.

[4] May be shared by non-governmental services upon proper showing of need and proof of non-interference.

[5] Later determination to be made by the Commission regarding the allocation of all or a part of this band to FM Broadcasting, Non-Govt. Emergency Service, Facsimile Broadcasting or Television Broadcasting.

[6] Exact channel width and distribution to be determined later.

[7] Assuming an average channel width of 60 kc., the minimum provisions in the band from 156-162 mc. will be distributed as follows (exact assignments to be determined later): Fire, 20 channels; Forestry and Conservation, Marine, Urban Mobile Experimental, 7 channels; Special Emergency, 6 channels; Power, Petroleum and Other, 5 channels; Provisional, Motion Picture, Relay Press, Relay Broadcast, Geophysical, 4 channels; Railroad, 33 channels; General Experimental, 5 channels.

[8] To be used temporarily for "special" air navigation aids. Band to be exclusively Amateur when no longer required for its present purpose. Amateur power to be limited to 50 watts during the occupancy of air navigation aids.

[9] Temporarily for "Special" air navigation aids.

[10] Same as 9.

[11] May be used for low power fixed point-to-point for such Services as Studio-Transmitter Links, Control Circuits, Police fixed Facsimile Circuits, etc.

—30—

COMMUNICATIONS AIRBORNE

By CAPT. EDWARD J. FLYNN
Hdqs., Airborne Ctr., Army Ground Forces

Closeup of SCR-300 with aerial being extended for above-ground operations.

In any airborne invasion, complete communications are necessary for successful operations. This article describes several of the receiver-transmitter units used by our troops.

"HEY, Joe. For Pete's sake, will you get some fire on that hill up there—they're giving us hell down here."

The crisp, laconic tones bellowed into the mouthpiece of the handie-talkie, held nervously in the sweating hands of the parachute lieutenant, told a very gripping, realistic story.

The members of this parachute infantry organization had been spewed out of the sky sometime very early on the morning of June 6th somewhere on the edge of Cherbourg, France, and the unit was now engaged in moving in for the attack as the amphibious forces reached the beaches sometime around dawn, about five hours later.

The lieutenant's hands perspired because he was sweaty with fear and anxiety concerning the safety of his men and himself who were trapped in a field beneath a hill from which German machine gun fire was spattering over the countryside. He had cause to be worried.

He had first uttered the above words

Most of the communications equipment is usually dropped by separate parachute. Paratroopers attempt to make their landings as close to the equipment as is humanly possible so that no time is lost in setting up communications.

into his only means of communication with anyone, but nothing seemed to happen and the lead continued to spray around his little group as they fanned themselves out over the surrounding area. Now, with the lead getting hotter and the lieutenant more anxious, he began to yell into the mouthpiece, hoping that this would bring some action.

The yelling didn't do the job but the fine performance of the radio set soon showed itself and within a short while friendly artillery fire had been lobbed into the hill, causing the retreat of the men in the nest.

It is quite late in this war to comment on the part that communications are playing and have played in the conduct of the war. Communications have been excellent and although in the case of the above, paratroopers nerves might have been a bit frayed, in the long run, they did the job they were called upon to do.

On D-day on the coast of France, the spearhead of the main attack and the first soldiers to set foot on the French soil in this war were the paratroopers of the 101st and 82d Airborne Divisions, who had received all their airborne training under the competent guidance of the crackerjack staff officers of the Airborne Center, Camp Mackall, N. C.

Many of those first invaders well remember their many maneuvers and command post exercises in the scrub pine and sandy, filthy terrain of North Carolina and thank their lucky stars that they had plenty of experience before they ventured into the "Big Show."

It was on maneuvers and command post exercises that the faults of airborne communications made themselves known and consequently were corrected. It was the corrections and many refinements given the radio and wire equipment which enabled the airborne communications to function as well as they did when they were actually put to use.

Airborne communications, like the life blood of most fighting organizations, have to be set up fast, constantly maintained, and frequently checked if the progress of the action is to be maintained.

When a communications paratrooper, loaded down with communications equipment, leaves his ship, he is carrying almost 350 pounds including his own weight. As he floats through the air his first thought is to land as quickly and safely as possible with all that equipment and get his radio set functioning.

If the man is a communications expert in a company or platoon, he may use the SCR-536 radio and will carry it strapped to his upper thigh in a special harness which has been constructed by the Test and Development Section of the Airborne Center, Camp Mackall, N. C.

This harness was developed principally because in previous action with the set on maneuvers or tactical problems, several defects cropped up

SCR-300 shown in operating position, directly after landing via parachute.

which had to be improved before the set was in working order.

When the parachutist jumped with the set, it was found on landing that the cap covering the antennas would be dented, the porcelain insulator at the base of the antennas might be broken or crushed, and the batteries would be found broken and consequently useless.

After several experiments with various types of harness for jumping with the SCR-536, the Test and Development Section finally evolved the present-type harness which is shown in the accompanying photos.

This harness can be worn with the webbing strap around the shoulder with the set carried underneath the arm or the belt can be worn around the waist and the set hanging down at the upper thigh on either leg.

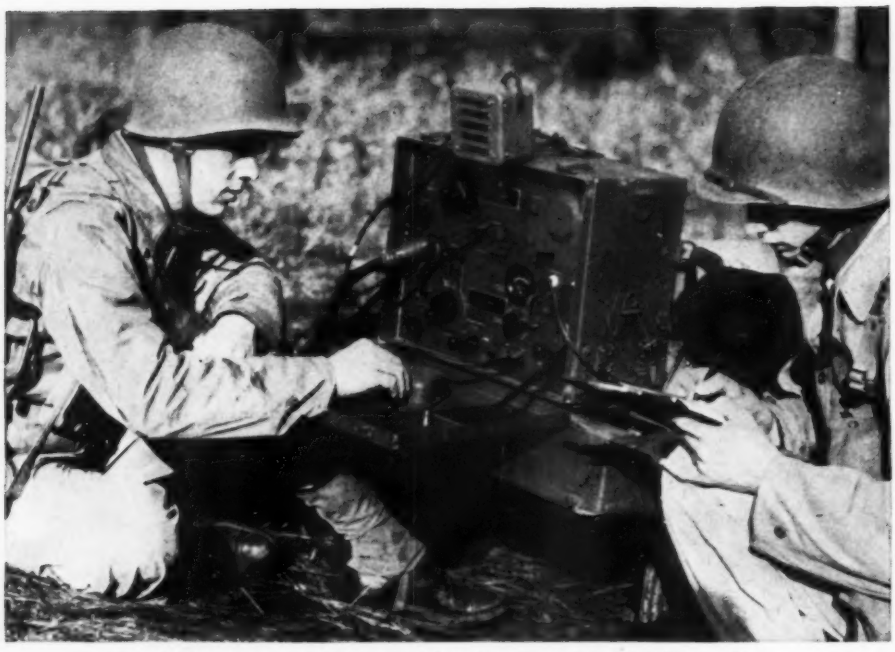
Either method is satisfactory since when landing the harness keeps the set strapped securely against the body of the 'chutist, preventing the jarring shock which had damaged the set in previous landings. The harness also has a small pocket at the top in which extra batteries can be inserted and protected during landing.

Another feature of airborne communications is the weight of every man and every bit of equipment which he is to use. The weight of radio sets is a major factor in the determination of their use for airborne operations. The set described above is one of the best for parachutists because it can be carried easily in the harness designed for it and be used in any position, allowing the freedom of one hand in case a man is forced to use a weapon against any enemy action.

In addition to the harness, a waterproofed canvas bag is carried by the parachutist to protect the set in the event the radio has to be used in adverse weather conditions. The parts of the set which might be exposed to the weather are encased in a special type of cellophane and coated with a special moistureproof and fungusproof preparation which prevents corrosion and electrical short circuits.

After the paratrooper has landed and has the SCR-536 in operation, he can communicate with his company commander, platoon leaders, or the signal elements of other platoons in case this should be necessary. This is

The SCR-536 being used by paratrooper from concealed position.



The SCR-284 in operation immediately after glider landing. Photo shows equipment mounted in handcart for rapid maneuverability.

Harness, worn around chest, permits easy movement and prevents injury upon landing.

an excellent set for such airborne operations for it enables the platoon or company leader to maintain immediate contact with the elements of his command as they execute their missions.

For speedy assembly and organizing of small groups such as platoons and companies, it so far has proved to be the best. Rapid organization of the smaller group is very essential in combat since the group loses its effectiveness as a combat team if it is spread out too far.

The story has been told of an airborne unit that was dropped on one of the small islands in the Pacific and one platoon given their orders to assemble at a certain point on landing.

As the radio operator hit the ground, the platoon commander was right beside him while the others of the platoon spread out. Pretty soon one of the members who had advanced pretty far forward heard this coming through on his SCR-536.

"Mike, the lieutenant says to tell those guys to keep their butts down as they go through that grass; these Nips are good tail gunners."

This particular lieutenant was able to see much better from his vantage point in the high grass and with the SCR-536 was enabled to keep in fairly close contact with every member of his outfit.

This set is not confined to communications between two stations since the accurately-calibrated crystals allow all platoons of a company to be netted together so that it is possible to communicate with all platoons simultaneously. In fast-moving situations this may prove to be the difference between success and failure.

In front lines where a very short distance may separate friend from foe, usually the signal commander will lay down the law regarding radio security. The SCR-536 is for voice operation alone and this could be waived only if the situation moved so fast that if the enemy did intercept the signal, there wasn't much they could do under the circumstances.

All in all the SCR-536 has proved to be a fine radio for airborne operations since many a paratrooper has been thankful for its being compact and lightweight and when he had to dig a fox hole he found he could operate his radio with the antenna above the ground while he could remain in comparative security and safety.

Another excellent radio used in airborne operations because of its lightness and compactness is the SCR-284. It has much more power and range than the SCR-536 and is used to control regiments and battalions.

Its increased size and weight do not permit it to be jumped with the parachutists so it is usually dropped from a plane in a bundle especially designed for this set.

The set is fine for parachute troops since it breaks down into a three-man load for transportation and operation and is built strongly enough to withstand the heavy punishment given by the airborne troops.

Since it is cumbersome and cannot

(*Continued on page* 120)

The SCR-284 is shown being operated by a crew of two men. One sends message while other operates hand generator.

The author, a member of the RTPB, presents his views on the important factors to be considered when designing, constructing, and installing television receivers.

A prewar credenza-type cabinet. This cabinet will have a built-in screen for larger-size postwar television pictures, obtained with a high-intensity projection tube.

THE *Design of* TELEVISION RECEIVERS

By A. D. SOBEL
Chief Eng., Air King Products Co., Inc.

FOR as many years as most of us can recall, television has been "just around the corner"; however, it never was quite able to progress beyond this point. Much has been said and written on this fascinating topic, still it remains quite unexhausted. It is the writer's honest opinion that a candid discussion will go a long way toward a better understanding of the problems in all their phases, and will above all, help to create a successful nationwide postwar television system.

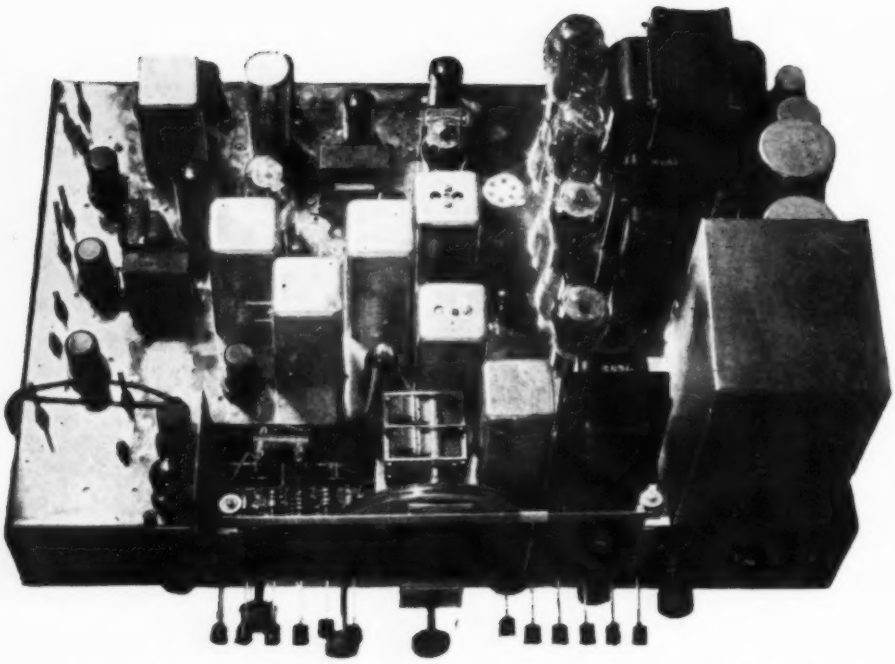
First, I should like to spend some time in a discussion of the known difficulties in television antennas. In the days when only one station was operating in the 44-50 mc. channel it was comparatively easy to install a dipole, with or without reflector, a twisted line, and receive acceptable pictures. Since the opening and use of the higher channels, obstacles have become apparent that play havoc with good reception. New antennas had to be designed with broadband characteristics, able to accept without much loss, the low and high channels now in use.

As we go up in frequency other problems also arise. The losses in the transmission line increase. An ordinary twisted line having approximately 14 db. loss per 100 feet at 50 mc. cannot be used above 80 mc. In order to see acceptable images with conventional receivers, the new "Copalene" or "Intelin" transmission line must be used. This type of line has a loss of approximately 6 db. at about 400 mc. Unfortunately, this is very expensive material and although it will go down in price after the war, it is generally believed that 75 feet, the average transmission line length for home use, will still be out of proportion in cost. Several manufacturers have done considerable work on loop antennas but this writer cannot foresee a very brilliant future. Generally speaking the loop antenna achieves an effect opposite to that which an outdoor antenna is supposed to accomplish, namely, to pick up a signal outside the noise area present in the average home. Although circuits can go a long way to help remedy this condition, little if anything can be done when the receiver is located in one of the newer steel and concrete apartment houses, or in private homes having complete aluminum or other metal foil insulation.

No satisfactory solution has been found as yet to the problem of suppressing echoes caused by buildings or structures nearby. We find that this becomes markedly worse on the higher frequencies, and until antennas able to suppress these undesired signals will be designed, ghosts will be a problem to all associated with television.

Color Vs. Monochrome

Unquestionably color is a great advantage for any picture, be it televi-



Prewar television receiver, Air King Model 1200. This chassis will be the type used after the war with the addition of modern improvements.

sion or otherwise; but the difficulties involved in both transmission and reception although not insurmountable, are of such a nature that careful investigation of the entire subject must be made, and possibly a different set of standards may have to be applied. The system used before the war was based on an actual definition of less than 400 lines; this gave a rather coarse line structure but was somewhat covered by the color itself.

However, this coarse line structure is not very pleasing to the eye, besides lacking definition, and it would seem, therefore, that a larger number of lines should be used. This brings us to the bandwidth problem. It seems at present that about 8 megacycles would be needed to receive a good color picture and with that same bandwidth we could also reproduce a very high monochrome image. However, this is more easily said than done, for the design difficulties are just tremendous, not to mention the added cost. The r.f. section would have to be sufficiently wide to pass a band of 12 mc. which naturally would give us considerably less than the little gain we now are getting. Additional stages of intermediate frequency would have to be added if the over-all sensitivity were to remain as it is now, and the video stages would have to be broadened to about twice the present bandwidth, involving considerable difficulties with filter designs.

To complicate matters further multiple path reception is much worse, in effect, in color than black and white. The superimposing of two or several colors due to echoes produces a false over-all shading and will often show color composition totally different from the ones originally transmitted. This condition gets much worse as higher frequencies are used. At any rate engineers and scientists should push color television experiments with all their efforts so that the public can get its benefits at the earliest possible date.

Receiver Design Considerations

The size of the image is a problem that has been plaguing engineers for a long time because, as the size increases, the cost also increases. Moreover, cabinets cannot be designed to look graceful and at the same time house twenty-inch tubes, or even twelve-inch types as the length of these tubes is approximately twenty-six inches, which is too long for direct viewing (horizontal mounting). This means that they must be mounted vertically, which involves the problem of using a mirror, but inasmuch as a flawless type must be at least ¼-inch thick, new difficulties are encountered in the form of double images. One image comes from the silver and the other from the surface of the glass itself, and this is definitely not pleasing to the eye.

To overcome this difficulty, surface-silvered mirrors can be used, but besides being expensive and delicate, they are very difficult to protect against tarnishing. The only other alternative would be a solid metal mirror, silvered and highly polished but again, in this case, the drawback would be rapid tarnishing and we would have the same problem as that of the surface-silvered glass.

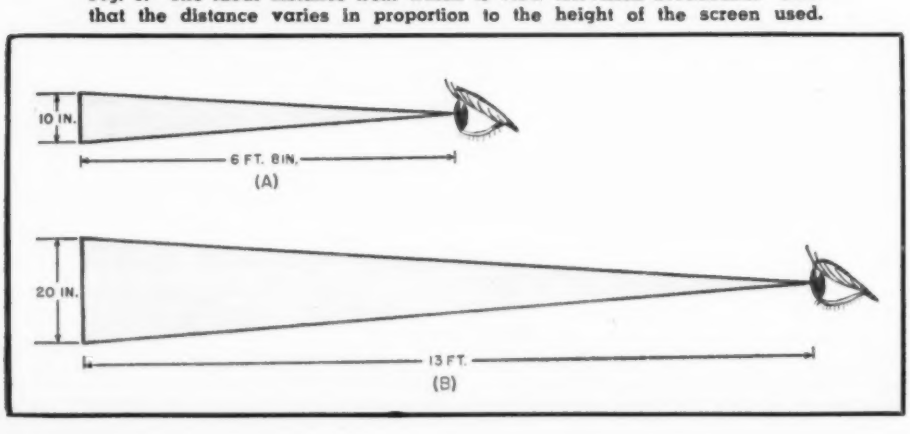
The only real solution for large pictures in the home is the use of projection tubes. When these tubes will be in full production they will probably not cost more than the present five-inch type. They adapt themselves well for use in consoles or attachments, as separate projectors may be called in the future. In an interview in 1937, this writer made the statement that projection tubes were the only solution and to this day still maintains his views.

High-voltage power supplies, delivering 30 or 40 kilovolts and still sufficiently safe for home use are being developed and will be a common sight in the near future. Not much is being said about screen materials these days due to wartime restrictions, but no doubt considerable improvements have been made. The placement of the screen upon which the image is to be projected is another problem, as is the choice of front or rear projection. Depending upon the individual designer, television apparatus employing projection tubes will most likely use two types of screens. The first will be a solid type, either silvered or beaded as is used in home motion picture work; the second, a translucent type for rear projection.

The placement of the screen itself is another problem to which serious thought must be devoted. There are three possibilities: front of the console, rear of the console, or entirely outside of the cabinet, such as perhaps hanging on the wall. The proposal of one manufacturer to hang the screen in the back and slightly above the television receiver is, in my opinion, unsound. The screen would have to be tilted considerably forward in order to avoid trapezoidal images, and most probably the cabinet would have to be moved away from the wall during projection.

Another method would be to have the picture emerge from the front or the side of the cabinet, and be pro-

Fig. 1. The ideal distance from which to view television broadcasts. Note that the distance varies in proportion to the height of the screen used.



jected upon an opposite wall. However to this there are two immediate drawbacks: first, the fact that the sound would, in all probability, come from the cabinet, while the picture would be visible on the opposite side of the room, although this can be corrected by placing the speaker in an attractive piece of furniture situated near the screen Still nobody could walk across the room during a program, for this would cast a shadow.

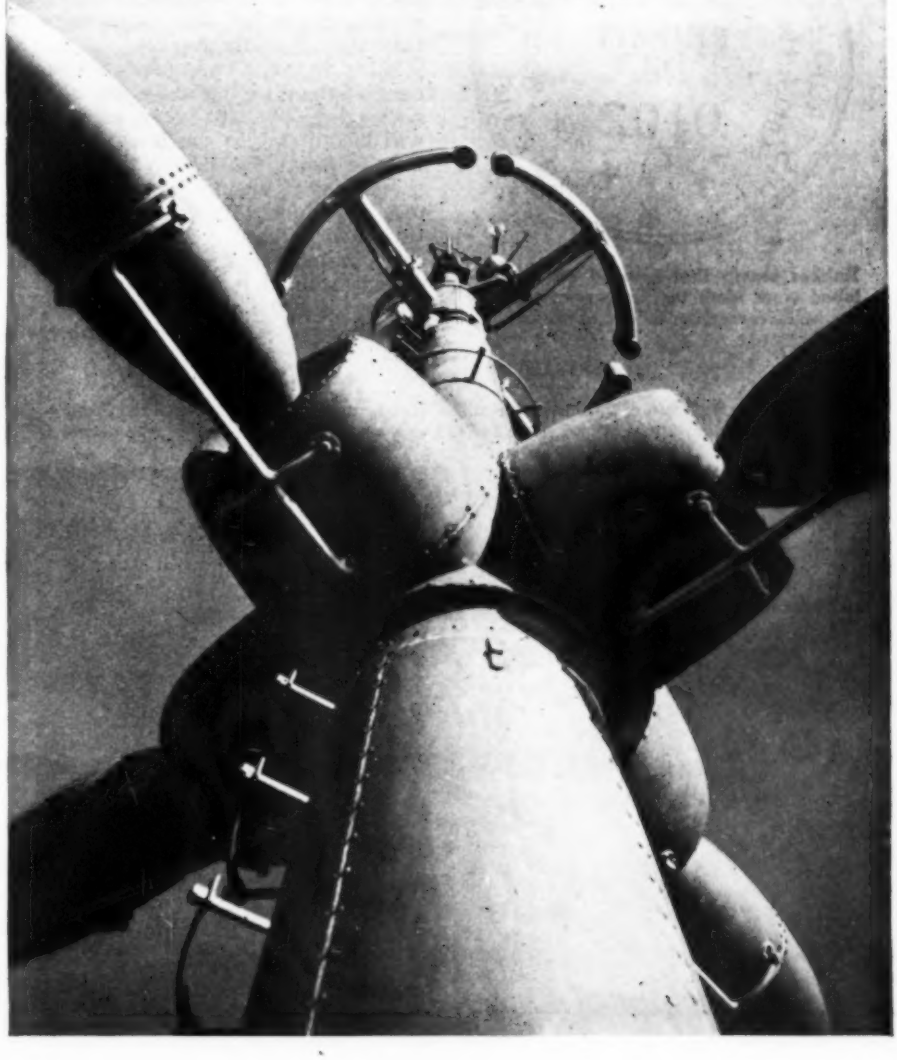
The size of the average living room must also be taken into consideration. See Fig. 1. If we follow the rule used in motion picture theaters, we find that the ideal place from which to view a picture is at a distance eight times the height of the screen, meaning that if the screen is ten inches high, the ideal spot would be 80 inches, or six feet, eight inches from the screen. If, however, the height of our picture is twenty inches, the ideal distance would be approximately thirteen feet. Inasmuch as this is longer than the average living room, one can readily see that too large a picture is not suitable for the home.

There will be those who claim that the screens used with home movies are very large. To this I reply that the average time duration of a home movie is between fifteen minutes to a half hour at most, and that any longer period is very tiresome. This is due to the fact that when located too close to the screen the eye cannot grasp the entire picture, and therefore the head must be moved sideways and up and down. This keeps the muscles of the neck in constant motion and is very tiring especially when fast action takes place. A television show usually runs from one to two hours.

The choice of tubes also must be carefully discussed. In the past, the metal 6AC7 and 6AB7 were the standby for television work. Experience in war work has proved that these tubes are not very satisfactory. The acorn tube, in the shape we know it today, is satisfactory from the standpoint of size and low capacity but is not well suited for mounting. The next best tube and the one most likely to be adopted for many uses will be the midget, of which the 6AG5 is representative. These new small tubes not only are electrically suited to television purposes, but their size makes for short leads and a compact chassis. They can be used equally well for h.f. oscillators, converters, i.f., limiters, discriminators, and video stages. Due to expanded manufacturing facilities for war work, their cost will not be unlike that of the tubes we have been using in the past.

There are other items to be considered before successful receivers can be designed. The front panel layout, although seemingly unimportant, must be so that good appearance is combined with ease of tuning and a minimum of knobs. The question as

(*Continued on page* 140)



(Top) Projection used by one television station when starting transmission. All receivers are then adjusted to obtain maximum contrast between black and white. (Bottom) NBC antenna, mounted on top of the Empire State Building. It is the latest design and is used simultaneously for television and frequency modulation.

SERVICEMEN are ORGANIZING

By BERT DALE

RETA, a nonprofit organization of South Bend, Indiana, has set the pattern for industry self-policing.

RETA CAN IMPROVE YOUR RADIO ENJOYMENT

- RETA is a non-profit association of radio service men who hold monthly meetings at which they discuss methods for improving and upholding the standards of radio servicing.
- Results of these technical discussions are reflected in the better performance of any radio they repair.
- Reta was formed to help the radio listeners to know the difference between a skilled Radio Technician and one who is merely an amateur.
- For general information call 3-5839.

RADIO AND ELECTRONIC TECHNICIANS ASSOCIATION OF INDIANA, INC.

Advertisement appearing in all local newspapers, advises the public of the objectives of the association.

Rubber stamp that is used on all finished work identifies the serviceman as a qualified member of the organization.

FROM a radio serviceman's viewpoint, South Bend, Indiana, is a typical American city. Serving its metropolitan area of some 150,000 inhabitants are 30 or more radiomen—all of them, under war conditions, with as much work as they can possibly handle.

Like other servicemen elsewhere, each of them individually realizes that some day, perhaps very soon, there will be an end to the bonanza. They wonder what the public thinks about them, their business methods, their pricing scales. They shudder at the threat to industry goodwill, imaginary or justified, represented by the so-called "screwdriver mechanics."

The difference between South Bend and many other communities, however, is that the servicemen of South Bend have decided to do something collectively about their own future; and have been fortunate in having among themselves forward-looking men willing to devote much time and effort to the cause. Listen to one of these, John E. Lackman:

"The obvious thing for us to do, of course, was to form some sort of an association. That was going to be tough, because we've had associations before whose prime objective was for somebody to sell us something; and we've had associations that were nothing but pointless fraternal groups.

"It took a lot of man-to-man talk to get this new group started; and actually, we had to prove to ourselves over a period of time that we were sincere in our own objectives."

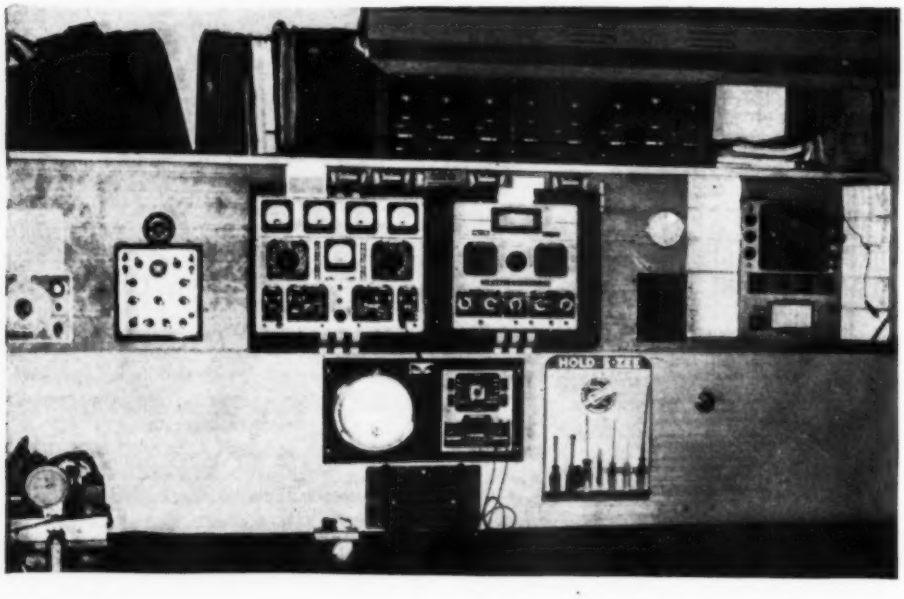
Lackman, Kenneth E. Fisher, and John Davies were among the prime organizers of the group which first informally called itself Radio Servicemens Club, and later became RETA—Radio and Electronic Technicians Association of Indiana, Inc. These three are now respectively president, vice president, and secretary-treasurer of the association.

The RETA program breaks down roughly into three phases: improvement of techniques, policing of the industry, and public relations.

The first phase is evidenced in the monthly meetings, at which a two-hour business session is devoted largely to technical discussions of methods, frequently with guest speakers supplied by leading manufacturers. Service problems and questions are discussed, with much helpful interchange of information.

With a start along these lines, the second phase developed almost naturally: the association would set up standards of efficiency and performance for its own members and would

Service bench of one of the members of the Radio and Electronic Technicians Association. Modern equipment and neatness of shop are emphasized by the organization.



endeavor to attract all those servicemen who held the same ideals.

These were more than just pretty words. A committee developed an entrance examination of 20 questions, designed to test a serviceman's practical knowledge, which prospective members must pass with a minimum rating of 60%.

Business practices became subjects of discussion, with mutual agreement reached on what constituted ethical procedures. When one member, for instance, commenced advertising city-wide free pickup and delivery service, this was considered unfair competition to those members who felt they should make a direct charge for such service. After discussion at a meeting, the advertised offer was discontinued.

The "estimate" problem was another one that was hashed out, with the satisfactory result that South Bend servicemen decline to make a "free" estimate on any radio repair, but charge an examination fee announced in advance if the repair is not completed.

The association does *not* attempt to set or control prices in any way, except that it is opposed to "unreasonable" charges and will investigate consumer complaints of alleged overcharges and either convince the customer or make an adjustment. Though the policy for handling such a case is established, no actual instance has yet arisen.

As close as the group has ever come to an actual comparison of prices, was a "test" at one meeting, at which a midget set in bad shape was exhibited. It had a noisy volume control, a bad tube, and other typical troubles. Each member examined the set and wrote his estimate of the repair charge on a piece of paper without signature, placing it in a ballot box. When the estimates were compared, the variation between the highest and lowest prices was only 75 cents!

"The way we feel," says Mr. Fisher, "is that the legitimate operator is nobody's *competitor,* but that the 'illegitimate' serviceman is a *bad* competitor. We don't propose to tell anybody in this business what they should or shouldn't do—but after mutual discussion we can, if necessary, eliminate from membership any obstructionist who does not agree with the opinion or policy of the majority of the group.

"So far, we have found that it is entirely possible to talk over any situation in a friendly manner, and to adjust our opinions as necessary through understanding and cooperation."

With this much of the program under way, RETA turned to the public relations phase. An identification placard and a rubber stamp to use as a seal on finished work had already been supplied to each member. Early this summer, the association commenced using small newspaper space at frequent intervals, to acquaint the public with the name of RETA and the objectives of the association.

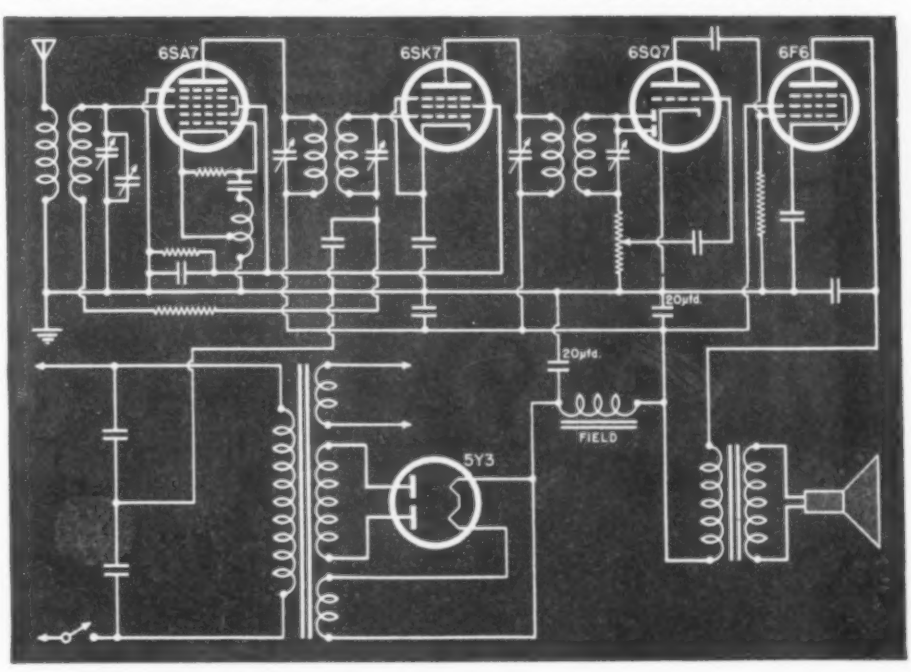
(*Continued on page* 140)

RETA EXAMINATION FOR MEMBERSHIP

1. **Locate nine errors in diagram (Fig. 1) and complete the circuit—adding all missing components.**
2. **If a tube shows practically the same voltage on the cathode that it shows on the screen and plate, what trouble would be indicated?**
3. **Assume the tubes all O.K. The output transformer overheats and set is dead. Trouble?**
4. **A service job comes in with following tubes in the sockets: 6A8, 6K7, 6Q7, 25L6 and 25Z6. A new line cord is needed. What resistance line cord?**
5. **If a dead set with the following tubes in the sockets came into your shop what would be the first thing to do? 6A8, 12K7, 12Q7, 35L6 and 35Z5.**
6. **We have a battery a.c.-d.c. portable which is O.K. on battery position but goes dead after playing 15 or 20 minutes on a.c. What would be the most likely trouble?**
7. **Why should the heater of the first audio tube in an a.c.-d.c. set be connected nearest the ground end of the heater series circuit?**
8. **What is the object of repeating high-frequency alignment at least once after making the 600-kc. rocking adjustment?**
9. **Name 3 or more commonly defective components which can cause distortion in the final audio stage.**
10. **In an a.c.-d.c. super what part or parts would be damaged if the 12SQ7 was accidentally placed in the 35Z5 socket?**
11. **If a set suddenly becomes low in sensitivity on the low-frequency end of the band while retaining fair sensitivity on the high-frequency end of the band what part would you check first?**
12. **What trouble would be indicated if an i. f. signal can be passed through a set but no b.c. r.f. signal can be put through.**
13. **We have a super in which one i. f. trimmer refuses to reach a peak. What part would you suspect as being defective? Tubes assumed O.K.**
14. **What trouble would be indicated if the screen grid of an output tube runs red hot? Set is dead. Tubes are O.K.**
15. **In a battery a.c.-d.c. portable we have an open input filter. Will the set play on a.c. and if so how will it's operation be affected? Why?**
16. **What part of a car radio might we term a necessary weakness?**
17. **What part of a car radio installation is of major importance in the elimination of motor noise?**
18. **What is a gassy tube and how do you go about checking a tube for gas while the tube is in the radio?**
19. **Name 15 tube types and identify them as to use.**
20. **Why is it advisable to replace the pilot light as soon as possible in a midget using a 35Z5 rectifier?**

Examination submitted to all applicants, which must be answered satisfactorily before membership in the organization is permitted. This method assures the public that all licensed servicemen are highly qualified to service radio receivers.

Fig. 1. When applying for membership in the RETA, servicemen are asked to locate nine errors in this drawing. Try it yourself; see if you can qualify as a licensed serviceman.



SERVICEMEN'S MULTIMETER

By WALTER C. HUNTER

THE radio serviceman needs all the help he can possibly obtain in these days. Priorities make it impossible for him to obtain signal tracing equipment.

This article describes the advantages and construction of a simple signal tracer well worth the small investment of parts and time required. Those of us who were fortunate enough to own the elaborate signal tracers seldom use them to their full advantage because of the time required to change channels and retune as we progress through a receiver. Just imagine the convenience of "walking through" a receiver from the grid of the first r.f. or converter tube to the voice coil of the loud speaker, listening to the signal at all points as you progress from circuit to circuit, whether the signal is modulated r.f., i.f. or a.f., all of this done with one probe, no switches to throw, and no dials or tuned circuits to adjust.

The simplicity of operation is such that much time is saved, even in location of commonplace faults. While this instrument does not include many of the desirable functions included in the more complex signal tracing instruments, it will perform all the important functions for rapid service, and will find much favor among the men who own other types of tracers. Not only is it faster in operation than other types, but its use will free other equipment for use on intermittent and difficult alignment problems.

Considering the circuit, we find it consists of three basic units: a signal tracing amplifier, an a.c.-d.c. electronic voltmeter, and an electronic ohmmeter.

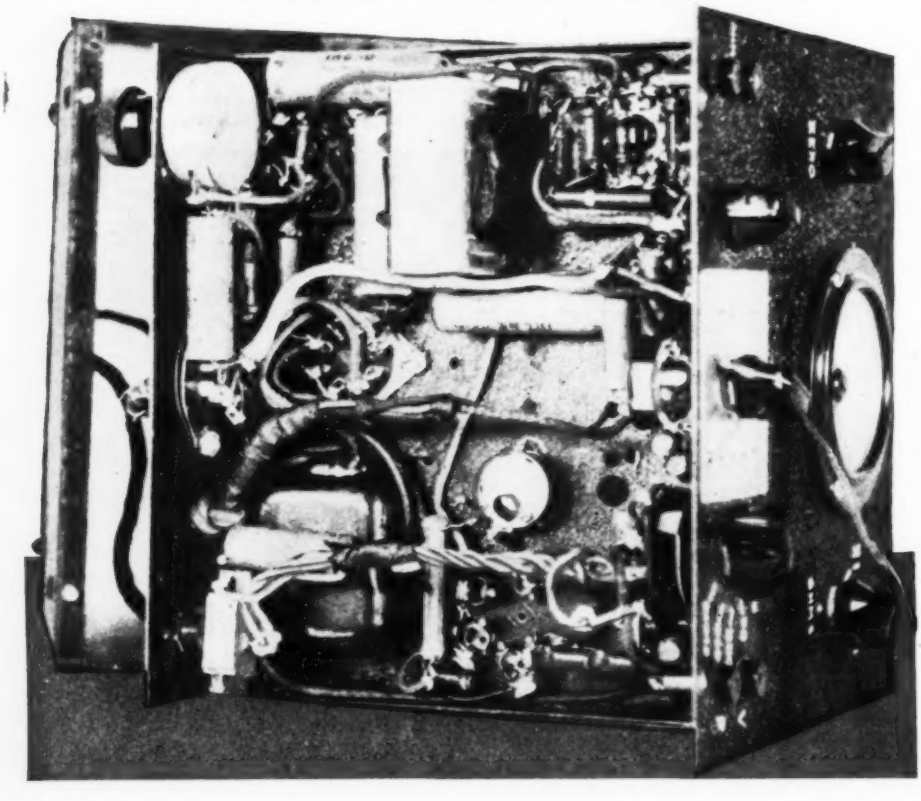
A 6F5, high-mu triode is used as the probe tube. This tube is a grid-leak detector providing detection of modulated signals of any frequency encountered throughout the r.f. and i.f. sections of the receiver. As we move into the a.f. section of the receiver this same probe, with no changes of any sort, becomes a contact-potential-biased first audio stage. The probe need only be brought close to the grid or plate lead of any high-level stage. Since the signal in the plate circuit of the 6F5 is a.f., irrespective of which section of the receiver we may be testing, the probe cable can be any convenient length. The second stage is a conventional high-gain pentode stage, while the third is a typical power amplifier stage, conventional in every respect except for the cathode-bias resistor.

The voltage drop in the 6K6 cathode circuit is used for the ohmmeter. Only ten volts are required for all ohmmeter ranges, since the ohmmeter is associated with the electronic voltmeter. The basic range of the electronic voltmeter is ten volts for full-scale deflection in either direction. The fifth position of the voltmeter range switch is electrically a repetition of the first position, with the exception that the ohms selector switch arm is connected to this terminal through a one-megohm resistor. The one-megohm resistor replaces the isolation resistor shown in the voltmeter probe.

Assume that the arm of the potentiometer in the cathode circuit of the 6K6 tube has been adjusted to a ten-volt setting. This is accomplished by setting the voltmeter range switch to the fifth or "ohms" position, shorting the test probes (connected to the "ohms" pin jacks) together and adjusting the "zero ohms" potentiometer in the cathode circuit of the 6K6 tube to give full-scale deflection of the meter, or ten volts. Full-scale deflection or ten volts corresponds to zero resistance on the ohms calibration of the meter.

Now, if the ohms selector switch is in the first or "X1" position, a resistor equal in value to the ohms calibration at the center of the ohms scale (in this case 4500 ohms) is connected from one pin jack to ground. If the unknown resistor, R_x, the resistance of which is to be measured, is placed between the probes, a value of voltage, E, equal to ten volts times 4500 divided by 4500 plus R_x will appear across the 4500-ohm resistor and will deflect the electronic voltmeter to a

Fig. 1. Underchassis view of the test unit. Note that switch SW_3 and R_9 rheostat are mounted directly to the back flange of the chassis.



This home-constructed unit, combining a signal-tracing amplifier, ohmmeter, and v.t.v.m. into one, makes a versatile test instrument for the home or shop.

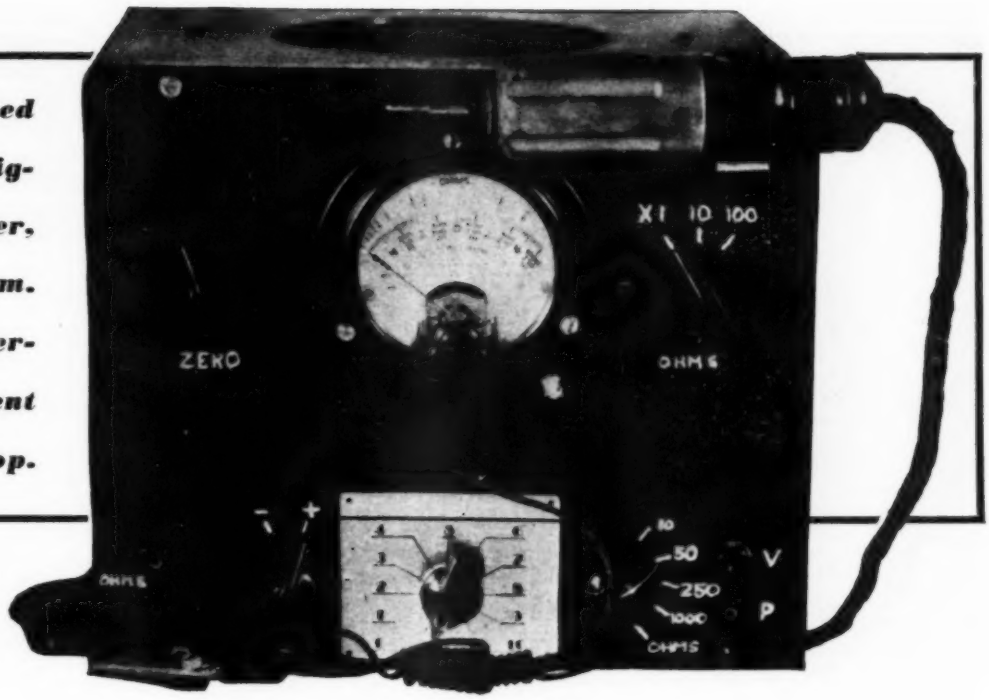


Fig. 2. Completed unit, showing proper placement of controls. A 0-1 milliameter is used.

point corresponding to the calibration on the ohms scale equal to the value of the unknown resistor. For example, if the unknown resistor happened to be a 4500-ohm resistor, when ten volts were applied to the terminals of the two 4500-ohm resistors (i.e. the unknown resistor and the "standard" 4500-ohm resistor) in series, five volts (10×4500/9000) would appear across the standard 4500-ohm resistor. This five volts would cause the electronic voltmeter to deflect to half scale and indicate 4500 ohms. Obviously with the ohms selector switch in the second or "X10" position 45,000 ohms would permit half-scale deflection, while the third or "X100" position would have a midscale deflection for 450,000 ohms. This third position is the one which would normally be termed a 10-megohm range. An additional range using a 4.5-megohm resistor as a standard would extend the range to 100 megohms, all using only the 10 volts derived from the cathode circuit of the 6K6.

The regular ohm scale of the meter movement incorporated in the electronic volt-ohmmeter circuit can be used. This is true whether the scale is a series or shunt type, that is, whether zero ohms corresponds to full-scale deflection or zero deflection, and whatever center-scale resistance indication the original calibration may indicate. The instrument illustrated uses a meter movement the ohms scale of which is of the series type; that is, zero ohms corresponds to full-scale.

For the other type of calibration the ohms test jacks position and ohms selector switch together with the "standard" resistors need only be interchanged as shown in Fig. 7.

The meter used had a center-scale ohms calibration of 4500 ohms. This requires the use of a 4500-ohm resistor

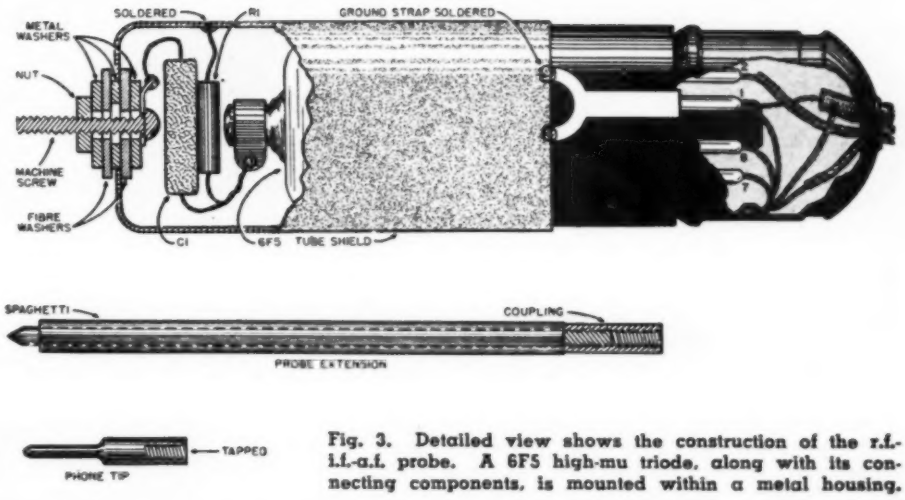
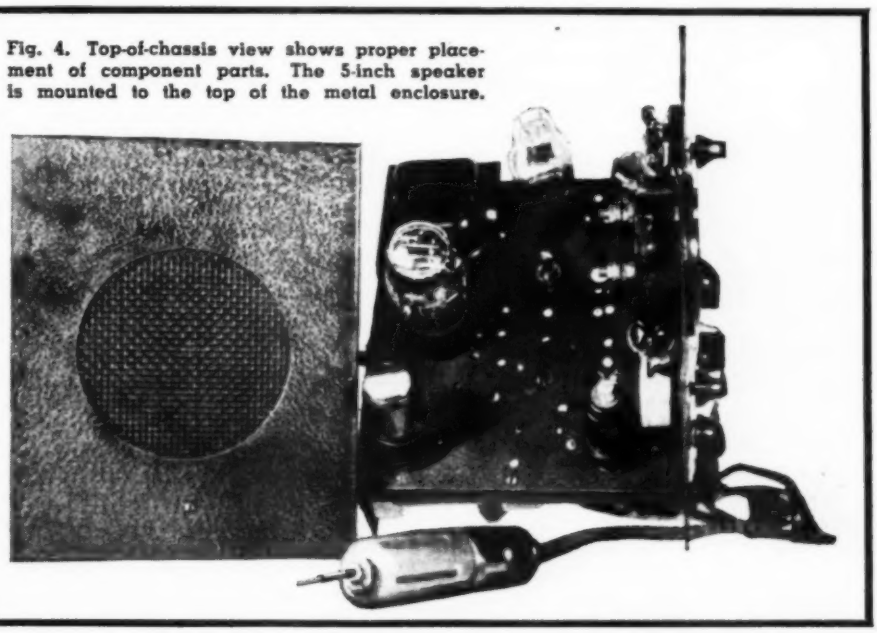


Fig. 3. Detailed view shows the construction of the r.f.-i.f.-a.f. probe. A 6F5 high-mu triode, along with its connecting components, is mounted within a metal housing.

Fig. 4. Top-of-chassis view shows proper placement of component parts. The 5-inch speaker is mounted to the top of the metal enclosure.



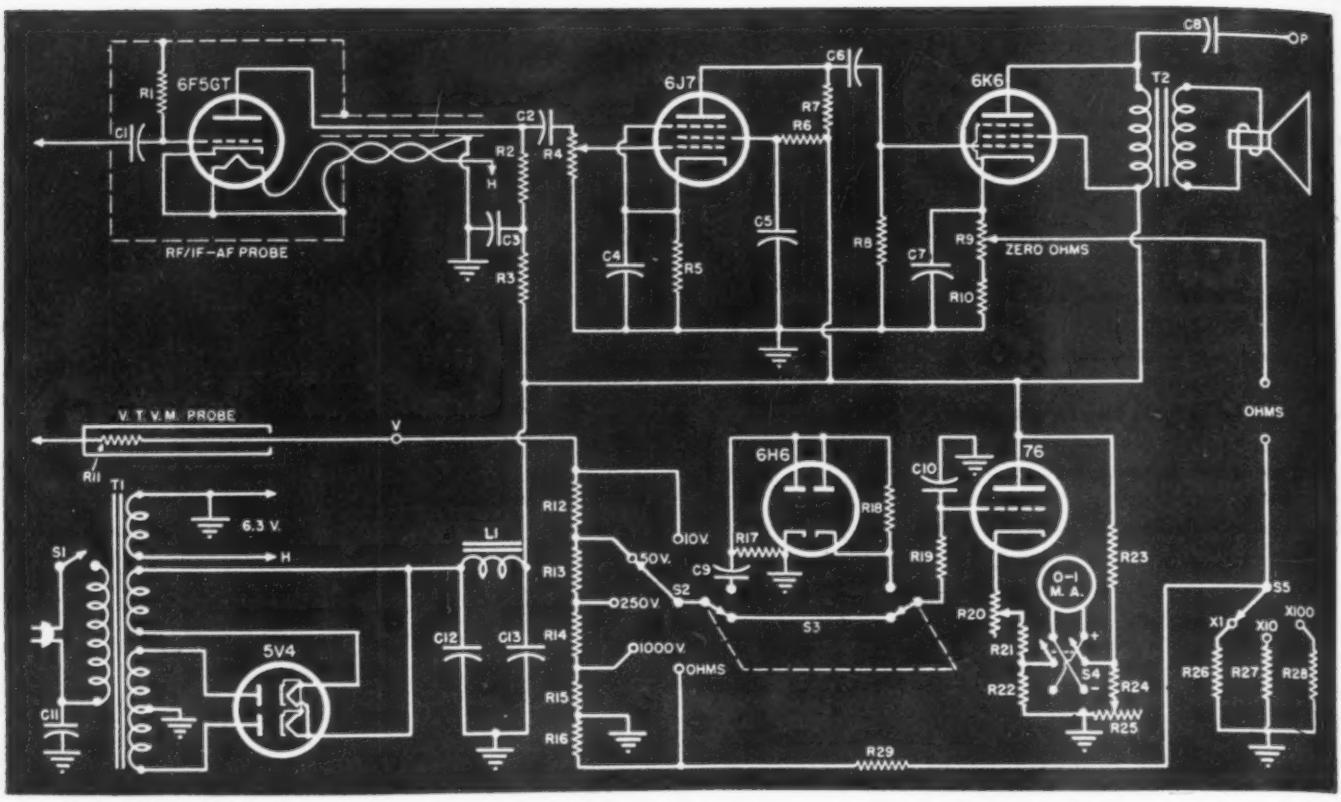


Fig. 5. The complete diagram of the multitester. It is a.c.-operated, employing a total of six tubes.

C_1—50-μμfd. mica cond. (25 to 150-μμfd. o.k.)
C_2, C_4, C_8, C_{10}—.01-μfd., 400-v. tub. cond.
C_3, C_6, C_9, C_{12}—.1-μfd., 400-v. tub. cond.
C_7—20-μfd., 25-v. elec. cond.
C_{13}—10-μfd., 450-v. elec. cond.
R_1—3-megohm, ½-w. res.
R_2, R_7—300,000-ohm, ½-w. res.
R_3—10,000-ohm, 1-w. res.
R_4—500,000-ohm, vol. control.
R_5—3,000-ohm, 1-w. res.
R_6—1.5-megohm, ½-w. res.
R_8—300,000-ohm, ½-w. res.
R_9—200-ohm pot. w.w.
R_{10}—200-ohm, 1-w. res.
R_{11}—1-megohm, ¼ to ½-w. res.
R_{12}—8-megohm, ½-w. ±1% res.
R_{13}—1.6-megohm, ½-w. ±1% res.
R_{14}—300,000-ohm, ½-w. ±1% res.
R_{15}—100,000-ohm, ½-w. ±1% res.
R_{16}—10-megohm, ½-w. res.
R_{17}—20-megohm, ½-w. res.
R_{18}—Determined experimentally (See text)
R_{19}—2-megohm, ½-w. res.
R_{20}—1,500-ohm var. res.
R_{21}—3,000-ohm, ½-w. res.
R_{22}—250-ohm, ½-w. res.
R_{23}—36,000-ohm, ½-w. res.
R_{24}—50-ohm, ½-w. res.
R_{25}—50-ohm var. res.
R_{26}—4,500-ohm, ½-w. ±1% res.
R_{27}—45,000-ohm, ½-w. ±1% res.
R_{28}—450,000-ohm, ½-w. ±1% res.
R_{29}—1-megohm res.
T_1—Small receiver type trans., 600-v. c.t., 70-ma.; 5-v., 3-amp.; 6.3-v., 3-amp.
T_2—Output trans. to match 6K6 to v.c. of speaker
SW_1—S.p.s.t. switch on vol. cont.
SW_2—S.p.5.p. rotary switch.
SW_3—D.p.d.t. (a.c.-d.c. switch) toggle or rotary to suit.
SW_4—D.p.d.t. (polarity switch) rotary.
SW_5—S.p.3.p. rotary switch.
L_1—Small filter choke (or speaker field if electrodynamic speaker is used).
Speaker—Small p.m. or dynamic (5").

for the "X1" range, 45,000 ohms for the "X10" range, etc. Should the meter used have had some other center-scale ohms calibration, say 5000 ohms, the standard resistor for the "X1" range would obviously have been 5000 ohms, the "X10" range 50,000 ohms, etc.

Electronic Voltmeter

The electronic voltmeter is a bridge circuit using resistors as three of its legs and the plate resistance of a '76 type tube as the fourth leg. The d.c. potentials to be measured are applied to the grid circuit through a moderately long-time-constant (integrating) circuit. These potentials modify the plate resistance of the tube, thus unbalancing the bridge and causing a deflection of the meter. Note the inclusion of a semivariable value of resistance (R_{20} and R_{21}) as an equivalent portion of the plate resistance branch of the bridge. This variable portion of the control arm of the bridge permits calibration, and once adjusted may be left in position. The 50-ohm variable section at the negative end of the bleeder arms of the bridge (R_{25}) is used for zero adjustment of the meter.

When the *IR* drop produced by the space current of the '76 tube through R_{22} is just equal to the *IR* drop produced by bleeder current through R_{21} and R_{25}, the two terminals of the meter are at the same potential and no current flows through the meter to produce a deflection. If, say, positive two volts be applied to the meter probe, the '76 space current increases causing an increased *IR* drop across R_{22} with a resultant electron current flow through the meter to this point. After proper calibration, this current will be two-tenths of a milliampere and will cause a deflection of two volts on a ten-volt scale. Obviously, a grid potential of negative relative polarity will result in a meter current flow in the opposite direction. Since it is always desirable to return the case of the instrument to points of low impedance, it is desirable to be able to read voltages of negative polarity without reversing probe connections. This function is provided by the double-pole, double-throw (SW_4) "polarity" switch in the meter circuit.

An input resistance of eleven megohms is achieved for all d.c. ranges of the voltmeter. The divider associated with the range selector switch has a total resistance of ten megohms, while an isolation resistor of one megohm (R_{11}) is included in the meter probe. This makes it possible to read such voltages as oscillator grid potentials without upsetting the oscillator circuit appreciably.

Shunt diode rectification is used for the a.c. ranges of the vacuum tube voltmeter. The principal inherent fault of diode rectification has been the sizeable contact potential developed due to the difference of the work functions at the boundary surfaces of the cathode and plate materials. This same phenomenon is the one so commonly utilized in biasing the triode section of 6SQ7 and similar tubes in recent receivers. For normal uses of a diode this small d.c. potential is of no consequence, but when the output of a diode circuit is to be fed to a sensitive electronic voltmeter the result is an initial deflection (of negative polarity) in the absence of applied signal. It has been common practice to use a battery, or a potential derived from the power supply to buck the contact potential. This has the disadvantage of being dependent upon factors entirely different from those which govern the magnitude of the contact potential. McMurdo Silver (1) and Guy Dexter (2), see references

(Continued on page 147)

The new Finch "Duplex" facsimile unit that transmits and receives simultaneously either by radio or wire circuits.

FACSIMILE TRANSMITTER and RECEIVER

Complete with power supply, this facsimile apparatus, weighing 25 pounds, has been designed for FM broadcasting and may be well applied to business and other commercial uses.

FACSIMILE as a commercial industry is new. The theory of facsimile, or the transmission of written messages by wire or radio facilities, was first undertaken more than 20 years ago. However, progress was slow because of a lack of any means of synchronizing the transmitting and receiving machines to the same impulses. The development of a synchronizing device capable of unifying by radio or wire the machines separated by great distances was developed and perfected by W. G. H. Finch. It was this invention which brought facsimile out of the experimental stage and made it for the first time a serviceable utility.

Facsimile should not be considered as a supplementary feature of present-day radio broadcasting. While it is kindred in its operation, facsimile is entirely different in the duty it accomplishes. Radio broadcasting is aural. Television is visual, but transient; it can be observed only at the exact time of reception. Facsimile is also visual, but it is not temporary. It leaves a permanent record, an exact replica of the material sent over its facilities. It can transmit anything which can be written such as maps, charts, messages, signatures, full-sized legal documents and even half-tone photographs.

The newly refined Finch "Duplex" facsimile unit, designed for postwar, was engineered to transmit and receive simultaneously either by radio or over ordinary telephone lines. Considering its intricate duty and remarkable performance, this unit is surprisingly small and compact. Its dimensions are 15 inches in width, 9 inches in depth and 14 inches in height. Complete with its power supply, the instrument weighs approximately 25 pounds. Housed in a streamlined case with a window which permits easy viewing of the recording and transmitting drums in operation, the unit is the most modern development in facsimile apparatus. It is designed to transmit and receive copy on paper, the size of standard telegraph forms, 8½ inches wide and 7 inches long. Two identical cylinders 7 inches long and 2½ inches in diameter, are employed to hold the copy and dry-electrosensitive recording paper.

Scanning is at the rate of 8 square inches per minute, 100 lines to the inch. This is equivalent in speed to approximately 150 words per minute when single spaced typewritten copy is transmitted.

Facsimile transmission is based on the ability of the photoelectric cell to change variations of light values into variations of electric current. A tiny beam of light travels across the message to be sent at the rate of 100 scanning lines to an inch. The light reflects from the message through the photoelectric cell which creates an electric current varying in intensity, in accordance with the black and white variations in the message. This current or series of electrical impulses is then sent over a wire or broadcast to the recorder. At the recorder, a needle, which is called a stylus, moves over a specially treated dry-recording paper at the same speed and in complete synchronization with the transmission scanner. The agreement of these two operations is accomplished by the transmission of a special "synchronizing impulse." This synchronizing device is the essential Finch contribution to the art of facsimile.

The fields to which facsimile has the strongest immediate appeal are primarily those where written messages are to be sent from or received at a point which is in motion. Before the advent of facsimile these fields were without equipment necessary for such communication. Previously the "listener" had to be in constant attendance with his receiver in order to catch the message. Even at that there was wide margin for error through loosely spoken words or misunderstood pronunciation. This "margin for error" has been reduced to a negligibility through the adoption of facsimile.

There is no end of businesses or other organizations which will find valuable uses for facsimile. Following are a few.

(*Continued on page* 110)

RADIO INDUSTRY

By I. M. CARROLL
Editorial Asst., RADIO NEWS

IT IS lunch-hour in a factory, manufacturing radios, parts, and accessories. A group of employees crowds suddenly around one of their fellow-workers. Half-eaten sandwiches are abandoned and paper cups of coffee grow cold as they gaze over his shoulder. Appetites are forgotten. Yet, the man's only attraction seems to be a few printed sheets of paper held in his hand.

This mystery unravelled simply means that Management in the radio industry, like so many other fields, has given the nod to application of an age-old and very human quality. Those printed sheets are the pages of the company house organ, the employee newspaper or magazine, that is fast building a new type of journalism in the radio-electronic industry of today. The centuries-old human characteristic that makes the house organ so popular is the same incisive, communal curiosity that gathered medieval wives in the town-market place, that brought knights and knaves to the same level in the wine-cup gossip of the taverns; it draws clerks and executives into the same "small talk" in lodge meetings or the weekly poker game.

This ingrained attribute, coupled with the newspaper-consciousness peculiar to the American way of life, has made the house organ an essential part of our industry's Labor-Management relations. It has become an important agent in greasing the ways of the high-pressure war production of today and moulding the smooth industrial efficiency necessary to supply the world markets of tomorrow.

House organs play this vital part in binding together, in close harmony, the Radio Industrial Family because Management finds the job well-nigh impossible to do by itself. Management policies and views, reports on equipment performance, incentive editorials to stimulate production, all are brought to every corner of the plant, into the hands of every employee, by these company journals with an ease and rapidity impossible to accomplish by human agency.

For example; handling one important phase of employee relations, morale, becomes greatly simplified through the pages of the house organ. Columns of personal notes and pages of photographs on social events and organizational activities soon make employees feel that they are important cogs in the machines—and they are! Interplant activities key them into friendly competition among themselves which soon finds expression in their work.

In picking up employee incentive, again house organs help by a direct method. Interest in production objectives can be kept at a high pitch by news of former employees in the armed forces and eye-catching drawings of Red Cross, Bond buying and community activities. The highly-prized Army-Navy "E" award always can claim a big spread because of its competition-stimulating value. News of promotions and shifts to more interesting work are always boosts to morale.

There are many experience-proven

GOES TO PRESS

Radio industry finds house organs create an incentive toward increasing military production.

methods in promoting safety programs or conservation of materials. Clever cartoons can carry the message with impressive effect. Witty slogans may serve as an effective vehicle to drive home similar ideas. Consistent follow-ups are as necessary as the initial steps.

At the outbreak of the war, the journalism of radio factory employee periodicals was a blurred mimeographed pamphlet hardly legible for those who attempted to read it. It was published and edited by the front office and consisted almost entirely of Management material. Today, the house organ, or factory newspaper, is a streamlined magazine written and edited in a professional manner by and for the employees. Due to extensive war work, personnel in the radio industry has increased and house magazines have continued to grow in size and popularity along with this increase in employees.

Confidence placed by Management in the house organ as a medium for

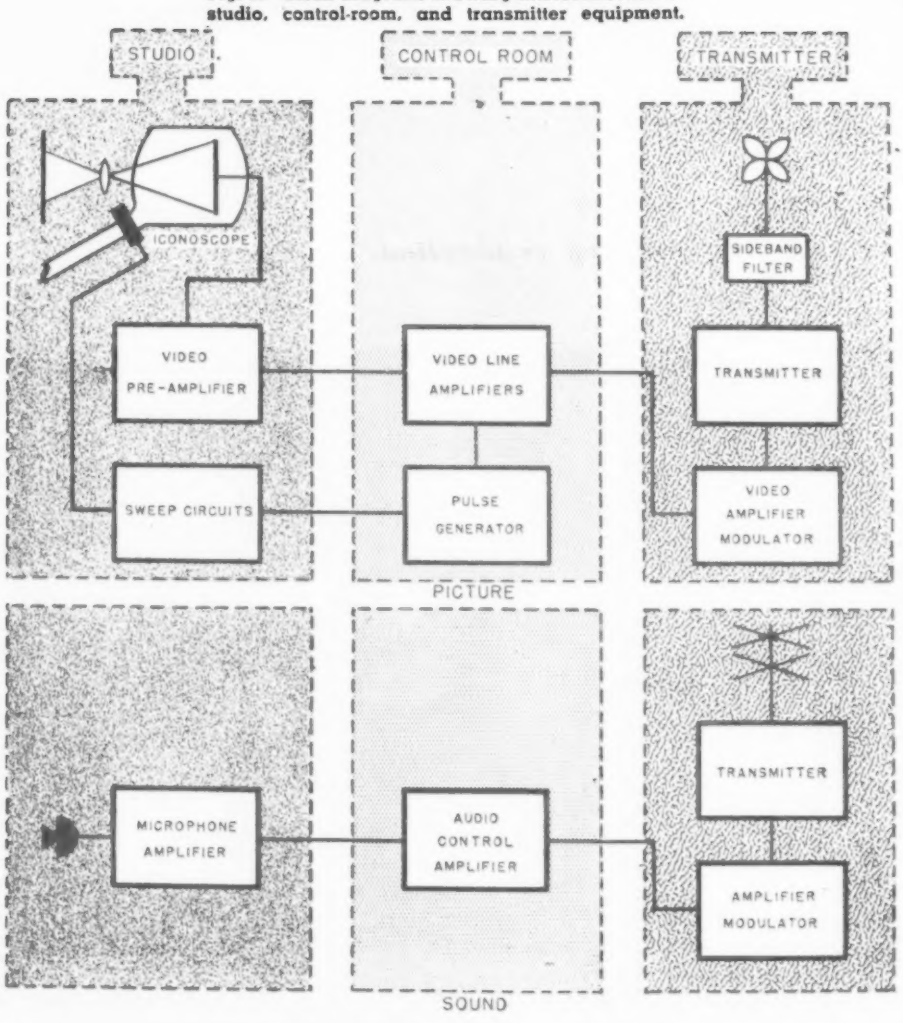
(*Continued on page* 136)

Eager employees scan the pages of the "Speaker" for latest news, at Stromberg-Carlson.

Television Transmitting Equipment

Fig. 1. Tube type 1849 is a typical studio size Iconoscope, while type 1847 is similar in operation, except smaller in design. Television scenes are focused on the photosensitive mosaic of the Iconoscope through a lens system which is adjusted by the camera operator.

Fig. 2. Block diagram, showing interconnection of studio, control-room, and transmitter equipment.



By EDWARD M. NOLL

Part 3. The design and operation of television transmitting equipment, including studio and control-room apparatus.

THE television signal is comprised of three types of information: (1) picture, (2) sync, and (3) blanking. At the transmitter, the picture signal is formed in the camera circuits; the sync and blanking, in the pulse generator; both signals combining in correct sequence in the video amplifiers. This composite television signal (discussed in detail in last month's installment) modulates the r.f. carrier of the high-frequency transmitter. Modulated carrier passes through the sideband filter which removes a portion of the low-frequency sideband, and, then, on to the high-frequency antenna where it is radiated.

At the receiver, the r.f. signal is de-

modulated and the information is segregated and passed into the proper channels: picture, to the control grid of the picture tube; sync, to the horizontal and vertical sweep generators; and blanking as cutoff bias to the picture tube during the beam retrace intervals.

The sound signal is generated by a typical high-frequency FM transmitter, the sound being transmitted on a carrier frequency 4½ megacycles above the picture carrier. At the receiver, the picture and sound carriers are picked up on the same antenna, pass through the same r.f. section, and are applied to the same mixer. However, the output of the mixer separates into two i.f. channels, the sound now appearing at an i.f. frequency 4½ megacycles below the i.f. frequency of the picture signal. The sound signal is demodulated by the FM discriminator, amplified, and passed on to the loudspeaker.

Studio Equipment

The television studio has both picture and sound pickup devices and associated preamplifiers. Microphones are mounted on the ends of long booms to assist in proper placement for correct pickup and to follow the action, still not permitting the microphone to appear in the picture. The television picture is initiated in the studio camera equipment which consists of a pickup tube (usually an iconoscope), video preamplifiers, and iconoscope sweep circuits, all mounted on a "dolly" which can be maneuvered into the most advantageous position for covering the scene to be televised. To produce a satisfactory signal at the output of the insensitive pickup tube, the object televised is brilliantly illuminated by banks of lights; some movable, others fixed. Special lights having high candle-power but only a minimum of heat radiation are installed for the comfort of artists and studio personnel.

The scene televised is focused on the photosensitive mosaic of the iconoscope through a lens system which is adjusted by the camera operator. A typical studio size iconoscope and another smaller size iconoscope are shown in Fig. 1; a typical iconoscope circuit, in Fig. 6. The iconoscope circuit consists of four major elements; (1) electron gun, (2) photosensitive mosaic, (3) signal plate, and (4) collector ring.

(1) The electron gun is in many ways similar to the electron gun of the ordinary cathode-ray test oscillograph except that the velocity of the electron beam is not as great. It consists of a cathode, which initiates the beam; a control grid, which regulates the intensity of the beam; a first anode, which in conjunction with the second anode focuses the beam; and a second anode, which imparts the final acceleration to the stream of electrons. Either magnetic or electrostatic deflection of the beam is used, under control of the camera sweep circuits which are synchronized with the

(*Continued on page* 131)

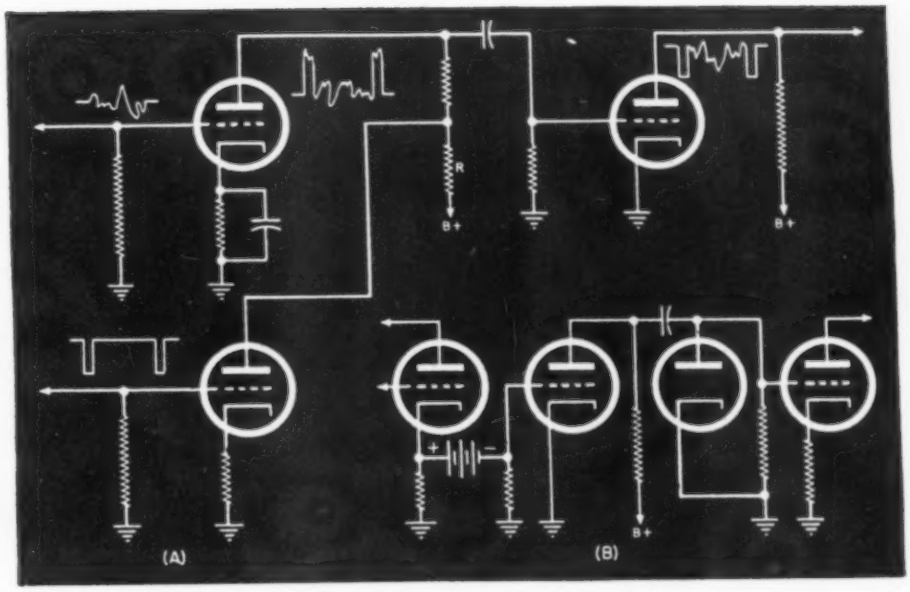


Fig. 3. (A) Illustrating method by which synchronizing and blanking pulses are added to the video signal. (B) Method of direct coupling the line amplifiers in the control room through coaxial cables to the transmitter vidio amplifiers.

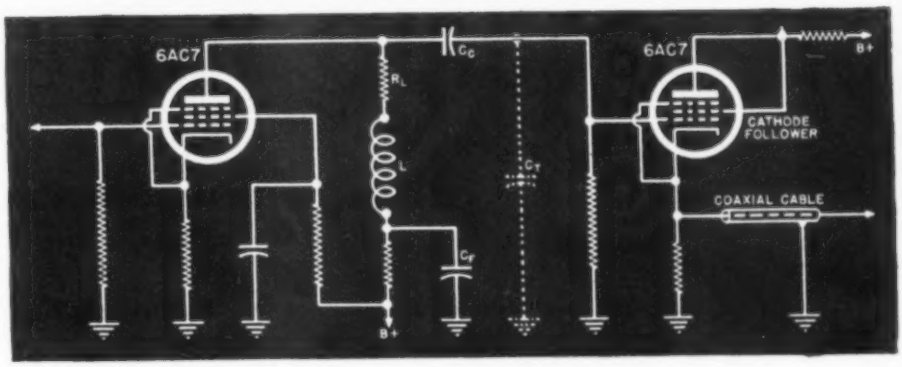


Fig. 4. A single 6AC7 is used to obtain wide-band video amplification. The output consists of a 6AC7 cathode-follower, connecting to a coaxial cable.

★ ★

Control room in studios of General Electric television broadcasting station WRGB, in Schenectady, New York. In the foreground is program producer; center, camera monitoring desk; and background, view of part of the studio.

Fig. 1. The simplicity of operation permits fast and thorough servicing of audio and video amplifiers.

Sine-Square Wave Oscillator

By McMURDO SILVER

Plainville, Conn.

The design and construction of a commercially-built test instrument, which simplifies analysis and testing of all types of audio circuits

IN THE December, 1943 issue of RADIO NEWS the writer described what is believed to be the first practical combination in one instrument of a source of both sine and square waves. Prior to that date testing and investigation of audio-frequency circuits via the slow and rather cumbersome sine-wave method was undoubtedly familiar to every laboratory worker as well as to the majority of serious servicemen. Square-wave testing was just beginning to come into general use, though it had enjoyed considerable publicity in engineering periodicals in recent years.

Since then the laboratory model generator described has been built by a number of investigators, to judge from their correspondence with the writer. It has been used in a number of laboratories with resultant saving of time due to the simplicity of analysis it provides for simple or complex circuits. It has been rather considerably improved in certainty and dependability of operation, and has been reduced to that commercial form in which it will be generally available after easing of WPB restrictions upon general purchase of test equipment, still one of the most critical production items of the war.

Many articles have been published presenting the advantages of square-wave testing which should make apparent to the progressive serviceman that this technique would save him hours of time and exasperation in audio-frequency circuit analysis. As sufficient time has since elapsed to permit study of the technique advocated, and as this new instrument, making its profitable application possible, will soon be generally available, a description thereof seems not out of place at this time.

Illustrated in Figs. 1, 2, and 3, and diagrammed in Fig. 4, the Grenby type OA sine-square wave generator may be seen to be quite simple indeed in comparison to the heretofore available combination of the usual sine-wave a.f. oscillator and separate and complex square-wave generator required to convert the sine-wave output of the conventional oscillator into square-wave form at a frequency determined by the oscillator itself. The new instrument is 14" long, 7" high, and 8¾" deep behind front panel. It is constructed almost entirely of aluminum, panel, chassis, and all other parts practical to this light and strong material being composed thereof in the interests of lightness and ease of transportation, to mention but a few of the advantages of aluminum for radio structures in contrast to cheaper and more popular steel.

The cabinet is finished in baked-on Navy grey enamel. This finish is both attractive in the contrast it provides to the reverse-edged black aluminum panel, unusually durable when subjected to hard usage, and by virtue of its gloss finish, capable of simple wiping or washing with soap and water as a means of maintaining indefinitely its original appearance. The absence of cabinet fastening screws in Fig. 1 is rather marked in contrast to usual equipment. They have been removed from the 3/32" thick front panel to one on each end and two in the back of the substantial 1/16" thick-welded cabinet.

The control simplicity of this multipurpose generator is strikingly evidenced by Fig. 1. At the upper left is a range switch knob permitting selection of any one of three ranges, each of which covers nearly a 15:1 frequency range. The large 5" dial at the center of the panel is calibrated directly in frequency, and is used with the range knob in decade fashion. With the range knob set to "X1" the dial figures are read directly as evidence of the frequency being generated. In the "X10" and "X100" range

knob positions the dial readings are simply multiplied by 10 or 100. Thus, the calibrated frequency ranges appearing upon the dial are 20 to 200, 200 to 2,000 and 2,000 to 20,000 cycles. The true range is from approximately 17 through 25,000 cycles, but in the interests of conservative engineering the extreme high and low limits of each range are not calibrated, although they may be employed in practice with considerable satisfaction. Accuracy of dial calibration in production instruments is within limits of minus 1½% to plus 1½% as extreme error, and may usually be counted upon to be accurate to approximately ± ½%, it has been found. Here again conservatism rules, the accuracy of calibration being rated at the poorest to be anticipated in volume production.

At the lower left of Fig. 1 are seen two binding posts labeled "OUTPUT," together with a toggle switch marked "10,000 ohm" and "500 ohm." Output may be had from the single pair of binding posts in terms of 10,000-ohm pure internal resistance, or at 500-ohm pure internal resistance. These two output impedance values suffice for practically all amplifier testing, but where intermediate values may occasionally be required, a matching transformer may be employed. Inclusion of one in the instrument is impossible in terms of the common output circuit employed for both sine- and square-wave output, since it is practically impossible to envisage a practical transformer satisfactorily operative from 20 cycles to 2,000,000 cycles, which is about the highest frequency present in square-wave output.

Next to the output binding posts and switch is the output volume or level control, permitting smooth, linear variation of output from zero up to the maximum of about 25 volts across 10,000 ohms which the instrument provides. This is a carbon potentiometer (R_{28} of Fig. 4) practically entirely free of the troubles usual to this type of control. This is because it uses not the usual resistive element of carbon or graphite painted onto an insulating strip, but employs instead a solid and sizable moulded resistance element imbedded in an insulating base. It is thus free of trouble, dependable in the extreme, and desirably nonreactive in character. To its right are power on-off lamp bezel and power switch.

Though they form no part of the technical aspects of the design, it is desired to call attention to the control knobs, believed to be quite refreshing in their functional simplicity. They are practically identical in cleanness of appearance and freedom from frills to those found upon military and aircraft equipment designed with no thought of cost whatsoever—where the controlling mind is concerned only with perfection in all details of construction, functioning, and appearance. Their serrated edges provide the essential function of easy gripping without slipping, the ability to "roll" the dial with the edge of a finger without the finger encountering bumps as in usual knobs, and their appearance satisfies that pre-eminent requisite of art that the product shall be seemingly effortless in accomplishment and pleasing to the eye in simplicity. Certainly they are a far-cry from the gaudy, but seldom neat, knobs found upon most radio equipment, knobs usually made gaudy to catch the public's eye against competition, but with little thought to lasting beauty or ease of manipulation.

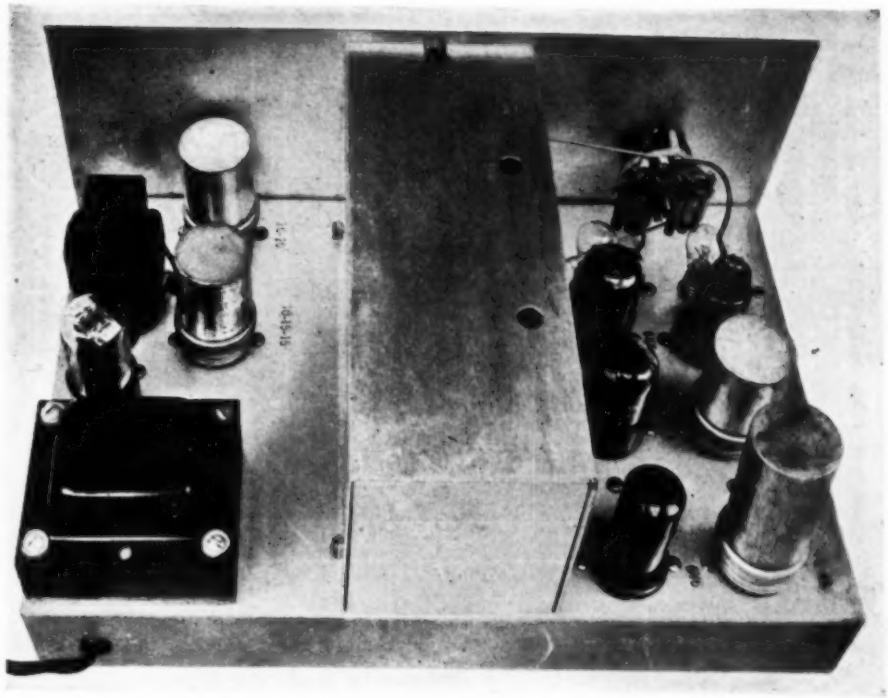
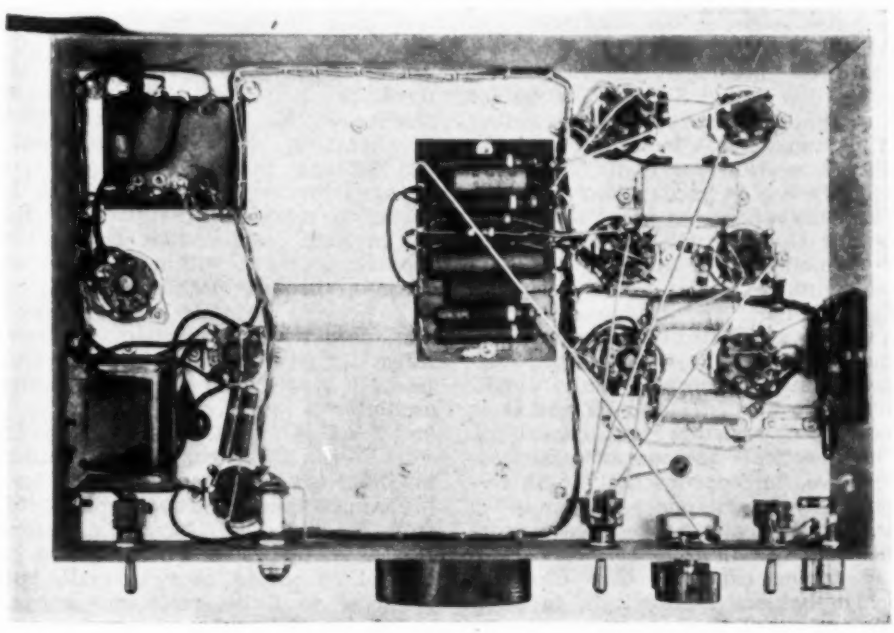


Fig. 2. Interior view, showing component parts arrangement with logical circuit layout, and proper shielding and spacing so essential to hum-free operation.

Construction-wise Figs. 2 and 3 tell a fairly complete story, coupled with Fig. 4. Turning first to Fig. 4, the instrument consists of a two-tube Wein bridge a.f. oscillator producing unusually clean sine waves anywhere within the specified frequency range of 20 through 20,000 cycles. For sine-wave output this oscillator, consisting of tubes V1 and V2, feeds directly into the grid circuit of V4, a triode-connected 6V6 which serves as output-isolating power amplifier. For square-wave output the 6SL7GT dual triode, V3, is switched into circuit between the oscillator and output amplifier to transform the sine-wave output of the oscillator into square waves. This is accomplished in the saturated two-stage direct-coupled amplifier of V3

Fig. 3. Under-chassis view exhibits a combination of old fashioned direct bus-bar wiring for sensitive circuits and cable wiring for low-frequency power connections.



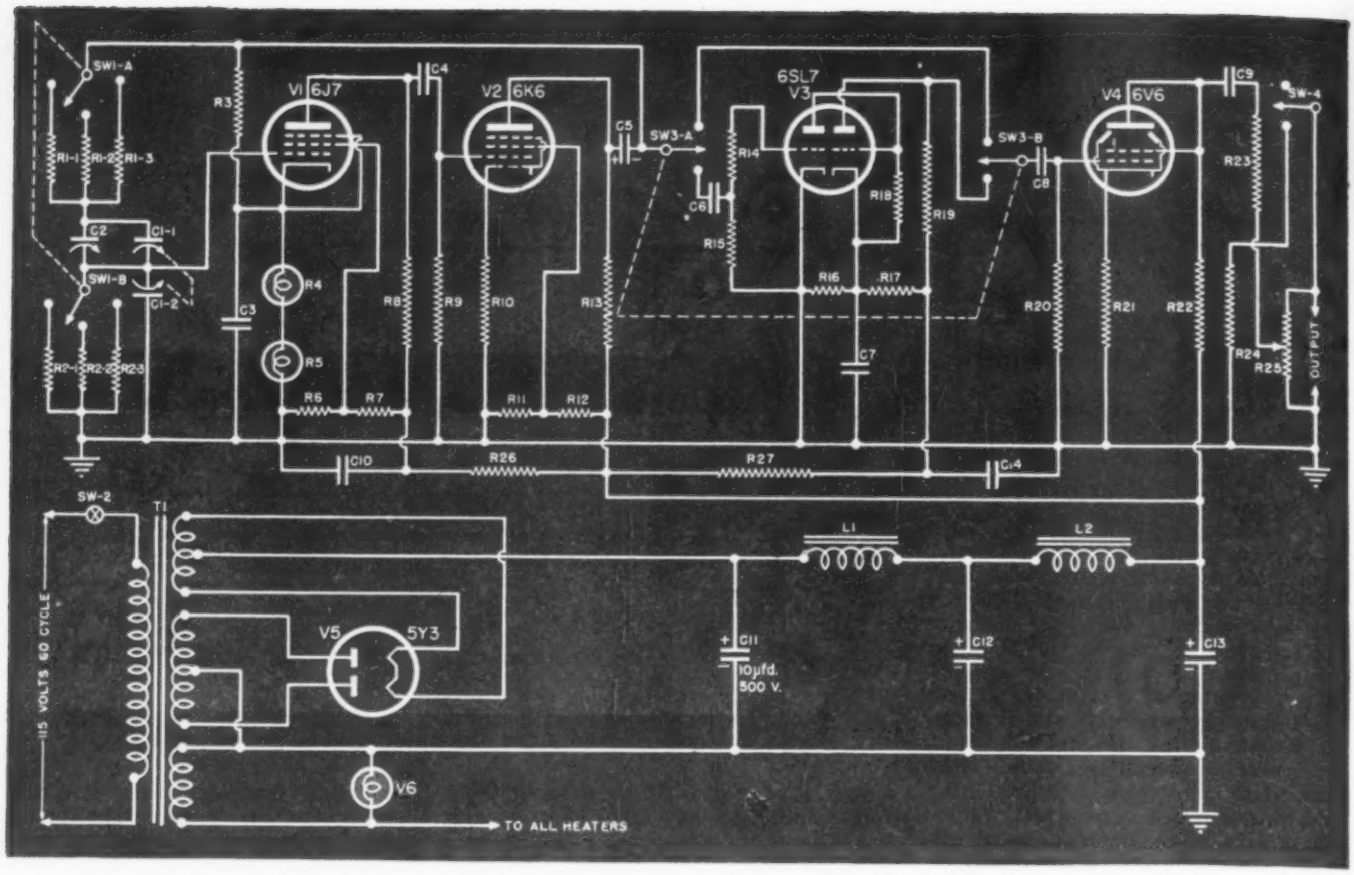


Fig. 4. Wiring diagram of the test unit. For square-wave operation, a 6SL7 tube is switched into the circuit between the sine-wave oscillator and output stage. A Wien bridge audio-frequency oscillator is used to obtain pure sine waves.

C_{1-1}, C_{1-2}—4-gang, 440-μμfd. tuning cond.
C_2—7-45-μμfd. rotary ceramic trimmer cond.
C_3—50-μμfd. mica cond.
C_4, C_6, C_8—0.1-μfd., 400-v. metal sealed oil cond.
C_5—40-μfd., 450-v. plug-in elec. cond.
C_7—16-μfd., 350-v. plug-in elec. cond.
C_9—40-μfd., 350-v. plug-in elec. cond.
C_{10}, C_{14}—20-20-μfd., 450-v. plug-in dual elec. cond.
C_{11}, C_{12}, C_{13}—15-15-μfd., 450-v., 10-μfd., 500-v. plug-in elec. cond.
R_{1-1}, R_{2-1}—10-megohm, ½-w. ±1% res.
R_{1-2}, R_{2-2}—1-megohm, ½-w. ±1% res.
R_{1-3}, R_{2-3}—100,000-ohm, ½-w. ±1% res.
R_3—2,000-ohm, ½-w. res.
R_4, R_5—Mazda S6, 125-v., 6-w. lamp
R_6—33,000-ohm, 1-w. res.
R_7—75,000-ohm, 1-w. res.
R_8, R_{10}, R_{17}—50,000-ohm, 1-w. res.
R_9, R_{14}, R_{15}—½-megohm, ½-w. res.
R_{10}, R_{21}—500-ohm, 2-w. res.
R_{13}—50,000-ohm, 2-w. res.
R_{12}, R_{23}—10,000-ohm, 2-w. res.
R_{18}—10,000-ohm, 10-w. w.w. res.
R_{19}, R_{19}—8000-ohm, ½-w. res.
R_{20}—2-megohm, ½-w. res.
R_{22}—8000-ohm, 5-w. w.w. res.
R_{24}—500-ohm, ½-w. res.
R_{25}—10,000-ohm linear taper pot.
R_{26}—10,000-ohm, 1-w. res.
R_{27}—4000-ohm, 1-w. res.
L_1, L_2—9-henry, 85-ma. filter reactor
T_1—6.3-v. @ 3A, 5-v. c.t. @ 3A, 700-v. c.t. @ 85 ma., 115-v. 50-60 cycle power trans.
SW_1A, SW_1B—2P3P rotary ceramic switch
SW_3A, SW_3B—D.p.d.t. toggle switch
SW_2, SW_4—S.p.s.t. toggle switch
Tubes: 1—5Y3, 1—6J7, 1—6K6, 1—6SL7, 1—6V6

in such manner that the square-wave output voltage obtained is substantially equal to the sine-wave output obtained without the dual clipper, V3, included in circuit.

Starting at the left of Fig. 4, ganged three-position, two-circuit switch SW_1A and SW_1B select one of three pairs of resistors having values of 10 megohms, 1 megohm, and 100,000 ohms (low to high frequency) which form, in conjunction with the 880 μμfd.-per-section gang tuning capacitor C_{1-1} and C_{1-2}, the frequency-determining elements of the Wein bridge made up by these items, R_3, R_4, and R_5. The bridge circuit so formed is connected between the input and output of the two-stage, wide-band resistance-coupled audio amplifier made up of V1 and V2 and their associated resistors and capacitors. For practical purposes, feedback is negative, or degenerative, for all frequencies except one very close to bridge balance as established by correct setting of the range switch SW_1, and tuning capacitor C_1. Close to bridge balance feedback is, in practice, positive, resulting in oscillation through proper phase of input to output coupling of the two-stage amplifier. Two ordinary 125-volt S6 lamps, R_4 and R_5, provide a special effect in that their resistance varies with temperature, which is a function of voltage and current. They are part of the feedback circuit, made up of themselves and R_3, which is about 70% degenerative. As the oscillator output voltage varies as frequency is changed by the dial, the feedback is caused to vary automatically by R_4, R_5, in such fashion that output remains constant to within 1½ db. from 20 on up through 20,000 cycles.

To prevent variation in character of load used with the instrument from affecting frequency calibration and possibly power output, the two-tube oscillator is fed through switch SW_3A and SW_3B, a d.p.d.t. toggle switch, to V4. V4 is a triode-connected isolating amplifier, so connected to provide low plate impedance, isolation of oscillator from load, and low harmonic distortion as its own plate load is varied in control of output over a small, but nevertheless finite, resistance range.

The output impedance changing system is interesting because of its simplicity. The plate load of V4 is 8,000 ohms, shunted by from 10,000 to 20,000 ohms as the output control is varied, since the reactance of series capacitor C_9, of 40 μfd. capacity, may be neglected. Rather than vary the impedance seen by the load as the output control is adjusted, the load is left unaffected and the plate load is varied over a small range, not bothersome with the triode output tube circuit.

Thus, by shunting the 10,000-ohm output control with a fixed nonreactive 500-ohm resistor, the output impedance may be dropped from 10,000 ohms to 500 ohms very easily, with output voltage dropping correspondingly. This, however, is not believed to be serious, as 500 ohms usually will be required only for high-gain amplifier testing, where the problem is not how to get enough voltage, but how to get a definitely controllable voltage low enough so as not to overload the amplifier itself. This the output circuit nicely provides on either sine or square waves.

The dual clipper, or wave-squarer,

(*Continued on page* 98)

LET'S TALK SHOP

With JOE MARTY
Field Editor, RADIO NEWS

ONE of the many problems of the postwar radio industry is the proper installation of television receivers. A great deal of talk is going around about who can and who should install these receivers. Servicemen naturally feel that they are the logical ones to do this work—but upon investigation, it was found that they have only the vaguest idea of what is necessary to properly install these receivers. It requires far more knowledge and equipment than is available in most service shops today.

In order that we may have an orderly approach to the problem, it would be well to list some of the elements of these installations. Probably the greatest time-consuming element will be the proper placement of the antenna. Unless the receiving antenna is placed correctly so that it is in proper relation to the transmitting antenna, all sorts of troubles will be apparent in the television receiver. Generally a minimum of two men are required for even the simplest installation—one man works on the roof and the other man is at the receiver. They are generally connected by some means of telephone system, in order that they may communicate back and forth. The man on the roof generally has to shift the antenna several times before optimum results are obtained. It is readily apparent that if there is only a single man on installation, he would spend most of his time running back and forth from the set to the roof.

All metal objects in or near the roof seem to cause trouble in television installations. The reflections from nearby objects also constitute a serious hazard. All of these things must be taken into consideration before final installation of the antenna can take place. In the smaller towns, equipment such as ladders, safety belts, and numerous other things not ordinarily found in the average radio shop will be necessary.

To a certain extent, installations in outlying sections should be easier than those in large cities. In cities, the problem is immensely complicated due first to the fact that there are a great number of reflecting objects, as well as a great deal of shielding or shadows, which militate against a good television signal. The problem is further complicated by the fact that more than one television station is being operated and the customer will expect to receive equally well all television stations operating in the vicinity. This complicates enormously the placement of the antenna, and it probably will be necessary in these cities to erect an array of television antennas composed of several, each one servicing a single station. These will be connected through some sort of an amplifier located on the roof and the transmission will then have to be run to each individual apartment where some sort of a switching arrangement will be necessary in order that the customer can receive all the television programs being broadcast. Immediately it can be seen that this is no easy task and that installations such as these are not in the ordinary classification, but will require on the part of the installer a very thorough knowledge of television principles, as well as a good grounding in the technique of installation.

Training

It will be necessary that some system of training be inaugurated in order that the average good serviceman can properly install television receivers. A suggestion is made here that the individual manufacturers who are concerned with the sale of television receivers provide, through their local distributors, a fundamental training course in the installation of television receivers.

This course could be of a general nature, calculated to give the minimum fundamentals necessary for this work. It can be supplemented from time to time by written instructions sent out from the service departments of the various manufacturers. A continuation school should be held every year to keep the serviceman up-to-date on new developments and techniques. Undoubtedly, many of the radio training schools now in existence are planning television training courses. These courses should be implemented into the standardized program above mentioned.

The local set jobber would have to assume the responsibility of seeing that all servicemen who desired to receive this training were eligible and were permitted to do so.

A very important part of the training program should consist of training in the use of high-frequency test equipment. Most service establishments today do not have this equipment, since very little of it has been on the market due to the fact that the Government has absorbed all of it for its own use during the war. However, all servicemen who have had training in the use of test equipment as we now know it, should have very little trouble in learning to use this high-frequency test equipment. This, of course, means that the individual service shop will have to spend far more money than they have ever spent before for equipment, in order to do a proper job of installation. Plans should be laid now to accumulate the necessary funds for this equipment.

Compensation

The third element in the installation of television receivers is, of course, compensation. Many people in the industry feel that the customer should bear the cost of the installation, but unless receivers are priced at a net sales price plus installation, there is no fair means of charging for this installation service.

Since each installation presents different problems, it is unfair to charge the same price for all installations. By virtue of this fact, television receivers cannot be net priced to the customer and installed. This involves a change in thinking on the part of

(*Cont. on page 72*)

"The radio and your clock don't agree on the correct time—so you sent for me to fix your radio!!?"

Fig. 176.

THE SAGA OF THE VACUUM TUBE

By GERALD F. J. TYNE
Research Engineer, N. Y.

Part 16. The early manufacture and sale of the "Electron Relay" and other amateur tubes by Otis B. Moorhead.

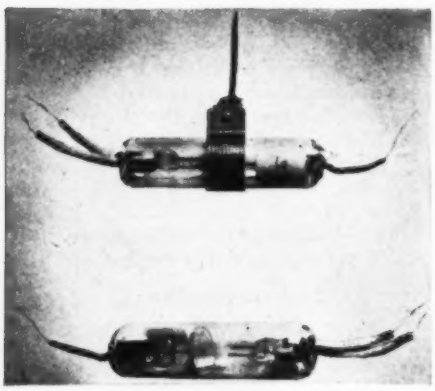


Fig. 177.

IN THE preceding installment of this series there was discussed a number of the so-called "independent" tubes, made prior to the advent of broadcasting and intended primarily for the amateur trade. One of these was the "Audio Tron," made by Elmer T. Cunningham, and which was later manufactured under license. The only other early independent manufacturer to follow a similar procedure, so far as the author has been able to ascertain, was Otis B. Moorhead, of San Francisco.

The first of the Moorhead tubes was known as the "Electron Relay," and this same name was applied to many of the later tubes which he made. It was the work of Moorhead and Ralph Hyde, and it first appeared in April, 1915.[233] Moorhead, who had for some time been an ardent radio fan, had worked in the de Forest booth at the Panama-Pacific Exposition early in the year, selling Audions. They sold so well that he was impressed with the possibilities of reaping a financial harvest by their manufacture. Hyde, who was an expert glass blower, had formerly been Superintendent of the Oakland Mazda Lamp Works of the General Electric Company, and had

Fig. 178.

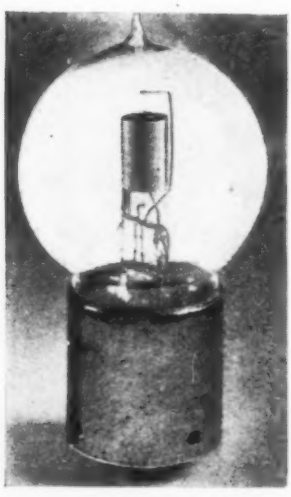


Fig. 179.

Fig. 180.

been repairing Audions as a sideline.[234] He left the employ of the General Electric Company on March 1, 1913, and later worked with E. T. Cunningham in the manufacture of the "Audio Tron." Hyde joined forces with Moorhead in 1915 to produce the Electron Relay, but this combination later split up and Hyde went back to making bulbs for Cunningham.

The first advertisement announcing the "Electron Relay" for sale appeared in July, 1916,[235] and announced that "the former manufacturers of the Audio Tron are now making a newer and better tube." The Electron Relay was advertised for use as an amplifier, detector, or oscillator, and could be obtained with either single or double filament. The "guaranteed" life was 400 hours per filament, and the price of the double filament type was quoted as $5.50. The advertisement was signed by "Pacific Research Laboratories—O. B. Moorhead, Manager."

The Electron Relay so advertised was similar in appearance to the Audio Tron, having a straight axial filament of tungsten, a coarse spiral grid of heavy (about No. 18 B. & S.) copper wire, and an anode of aluminum sheet bent into the form of an almost-closed cylinder. It was claimed that these materials were chosen because of their relative positions in the electrochemical series "and also because we could procure these metals with ease on the Pacific Coast."[236] It can scarcely be doubted that the latter of the two reasons was the controlling one. It was claimed that the Electron Relay was a "high-vacuum" device, being exhausted to a vacuum better than .04 mm. mercury.

The avowed purpose of the production of this new device was to "bring the sacred Audion to terms." What it first succeeded in doing was having the makers prosecuted for infringement of the Audion patents. With the Audio Tron, however, it furnished a source of tubes for the lean-pursed amateur and resulted, as has been previously told, in de Forest's putting on the market a similar tube, sold without the necessity of purchasing the $18 "little red box."

Although the author has been unable to find any advertisement prior to July, 1916 offering the Electron Relay for sale, it apparently had been sold to a considerable extent in 1915, since on February 15, 1916 the de Forest Radio Telephone and Telegraph Company filed complaint against Moorhead and Hyde, alleging infringement of seven of the de Forest patents. Several Pacific Coast radio "experts" submitted affidavits in reply to the complaint and in support of Moorhead and Hyde. This action was brought at the same time as that against Cunningham.

The action was begun by requesting an injunction against Moorhead, Cunningham, Hyde, and others. The Justice before whom the preliminary action was brought ruled[237] that since the validity of the de Forest patents had not yet been passed on, an injunction would not be granted, but that an indemnity bond would be required from the defendants until the question of validity had been settled. Apparently Moorhead posted the required bond since in July of 1916, the advantage of operating sub rosa having been eliminated by the court proceeding, the above-mentioned advertisement appeared.

The next advertisement, which appeared the following month (August, 1916)[238] announced that there had been a "25% improvement" in the Electron Relay during the preceding month, claimed that the new tube was the "Most Sensitive Wave Responsive Device Known," and was signed by the "Pacific Laboratories Sales Department," Moorhead's name not being mentioned.

Apparently Moorhead did not feel too secure in the matter of patent infringement since the next advertisement[239] was for a totally different tube, the "Moorhead Tube," with a single filament, but guaranteed for 1200 hours operation, and claiming a much superior performance. This advertisement is reproduced in Fig. 176. A photograph of this tube, given in Fig. 177, shows the radical change in construction. The anode had been changed from aluminum cylinder to aluminum disc, the filament from straight to hairpin-shaped, the grid removed from the tube and replaced by an external control electrode in the form of a perforated band of brass, clamped around the outside of the tube opposite the filament-anode space. The filament of this tube was intended for operation at 4 volts, and the anode voltage was stated to be 10 to 35 volts.

The manufacturer of the tube was indicated by the marking "Moorhead —Patent Pending" in raised letters on the circular disc anode. It is worthy of note that this was the first of the independent tubes to bear the name of the maker indelibly impressed thereon, and to carry information as to operating conditions. This tube with the external control electrode continued to be advertised for the remainder of that year.

Apparently this new construction was not as great an advance over the former one as was claimed, since with the advertisements in January, 1917[240] the external control electrode tube was given less attention and the Electron Relay came again to the fore. The Electron Relay which was advertised had again undergone improvement "within the last thirty days" and the "improved tube" could be identified by the letters "ER" stamped on the cylindrical anode. This tube is shown in Fig. 178. It may well be that the decision handed down in an Eastern court, holding the de Forest Audion patent to be subservient to the Fleming diode patent, had something to do with the reappearance of the Electron Relay.

In February, 1917 the "Pacific Research Laboratories" was taken over by "Moorhead Laboratories, Inc."[241] but the advertisements for the Moorhead tubes continued to be signed by the "Pacific Laboratories Sales Department."

In this month Moorhead sent to the

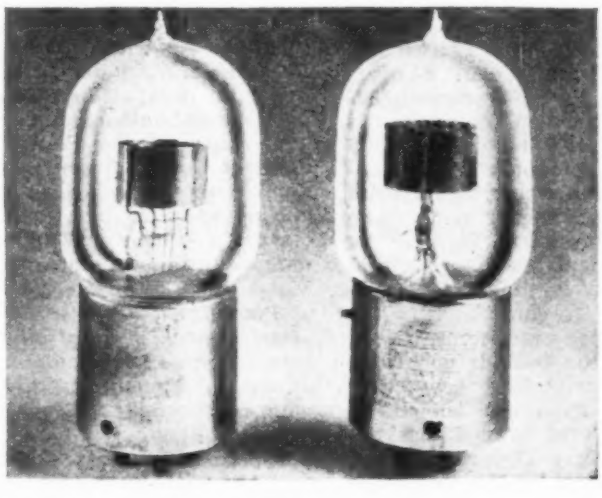


Fig. 181.

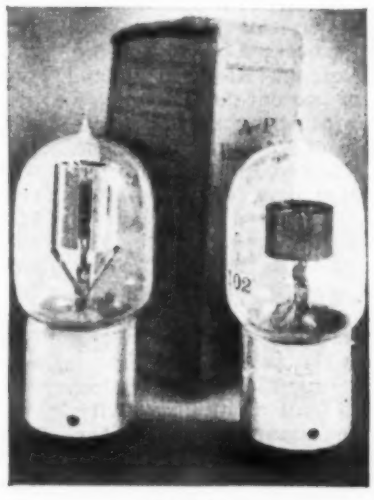


Fig. 182.

Fig. 183.

Fig. 184.

Institute of Radio Engineers a paper entitled "The Manufacture of Vacuum Detectors."[242] In this paper he described the processes used in the manufacture of the Electron Relay. In the light of present-day knowledge of the factors affecting the electrical characteristics of vacuum tubes, one statement contained in that paper is of interest. On page 429 Moorhead says:

"The spacing between the elements is not very critical in this type of device but it is best to wind the grid to a large enough diameter so that it will strike the plate rather than the filament when the tube is jarred."

With the Presidential Proclamation of April 6, 1917 all amateur activity ceased and the amateur market for this apparatus practically disappeared.

During World War I Moorhead made tubes for the U. S. Navy and for the British Government.[243] Those made for Great Britain were high-vacuum tubes patterned after the British "R" type valve. These tubes could be operated at 6 volts and .84 ampere filament. At 400 volts on the anode the tube was required to dissipate 15 watts for three minutes. When operated at 4-volts filament it had a life of 800 hours. The earlier models, one of which is shown in Fig. 179, had the axis of the element assembly vertical but later they were made with horizontal elements, to conform with the British and French practice. It should be noted that the bulb is spherical, also to conform with foreign practice.

The SE-1444 made for the U. S. Navy during World War I was designed by the Navy Department and made for the Navy by Moorhead. It was similar in construction to the tube made for British use except that the bulb was cylindrical and the element assembly vertical. It is shown in Fig. 180. The filament of this tube operated at 4.5 volts with a current of .65 ampere. It had a mutual conductance of 180 micromhos, amplification factor of 9 and anode impedance of 50,000 ohms. It was usually operated at 40 volts anode and — 1.3-volts grid.

After the war there existed a stalemate in tube manufacture because of the decision in the Fleming-de Forest patent suit. The first step toward breaking this stalemate was taken on November 30, 1918 when the Marconi Company granted to the Moorhead Laboratories a nonexclusive license to make and sell apparatus under the Fleming patent, for sale to amateurs and to any Government. By the terms of this agreement the Moorhead Laboratories admitted its past infringements, paid damages, and agreed to pay royalties to the Marconi Company on future products. With this agreement in hand the Moorhead Laboratories approached de Forest, with a view to obtaining a license under the de Forest Audion patents.

The end result of negotiations conducted over a considerable period was a series of agreements[244] between the Marconi Company, de Forest, Moorhead Laboratories, and Otis B. Moorhead as an individual. These agreements were first concluded on April 30, 1919, and later modified on June 6, 1919. They provided that Otis B. Moorhead and the Moorhead Laboratories were to manufacture tubes for de Forest. De Forest in turn agreed to sell all such tubes to the Marconi Company. The Marconi Company agreed to sell tubes back to the de Forest Radio Telephone and Telegraph Company, to be sold by them to the public for amateur and experimental use in radio reception and amplification. These agreements were to run until February 18, 1925, the date of expiration of the Audion patent, except that they could be cancelled by either party on six months' notice.

The vacuum tubes to be made under these agreements were of several types, described as follows:

Type A—This was a hard amplifier tube, the same as had been supplied to the U. S. Navy during World War I under the designation SE-1444. It had a cylindrical bulb and a standard Navy 4-pin base of the Shaw type. The filament was of drawn tungsten wire, approximately .0024 inch in diameter and about 13/16 inch long. The grid was an 11-turn spiral of nickel wire, with an internal diameter of .167 inch. The plate was of sheet nickel, about .009 inch thick rolled into a cylinder of about ⅜-inch internal diameter. The tube operated with a filament current of about .7 ampere at 4 to 5 volts, and with an anode voltage of 60 to 90 volts.

Type B—This was similar to tube "A" but with low vacuum for opera-

(*Continued on page* 144)

QTC

By CARL COLEMAN

AS WE go to press marine radio operators are still in demand and an urgent appeal for all licensed marine radio operators has been made, requesting their return to sea. Since the slightly premature cutbacks on production have been restored to full scale orders, skilled workmen are again in demand and that means radiomen. Get in touch with your local WSA, USES, or maritime union for detailed information regarding the positions open aboard ship.

JOSEPH M. WAGNER is out sailing aboard his Liberty. Eric Dunlop has taken out a tanker; that's one way of getting around gas rationing. Walter Glazar, ex-MRT marine radio serviceman ashore, has taken out a Liberty from the east coast. A. Leppik has been assigned a berth aboard one of the older cargo craft. E. Borgenhausen has also gone out with a tanker. B. Pedersen took out an assignment aboard a freighter. Terence O'Day and John Christian have both taken out Liberties. Per B. Johannassen is now with the ACS somewhere in Alaska. Sgt. L. C. Monett, radio opr. aboard a B-17 Flying Fortress, has been awarded the air medal, we hear, at a base in England. F. Bodine writes from Miami and informs us that WWPG did not go ACA as reported in this column a short while ago. Also received a nice letter from T/4 Upchurch, who dropped a line from somewhere in Germany.

THE special House committee investigating the FCC handling of the case of WMCA reported early last month that it had found nothing basically wrong with the transfer of ownership of that station.

AN INCREASE of about one hundred percent, a total of 1470 former seamen and officers, made themselves available to the merchant marine, during December, 1944 as compared with the same period during 1943, according to Craig S. Vincent of RMO in New York. This response to appeals for experienced merchant seamen has enabled the U. S. Merchant Marine to keep our supply ships running to the fighting fronts.

Both press and radio carried out extensive campaigns to reach as many as possible of the experienced seamen and officers with an appeal for their immediate return to sea duty. Despite the success of these appeals, however, it was reported that it is necessary for every experienced seaman and officer now ashore to report for active duty as the demand for additional personnel in the merchant marine increases every day.

The training of several thousand recruits and the additional schooling of other officers and men for higher rank continues and it was pointed out that the merchant marine must have the services of the older and more experienced men who left the sea for shore jobs in the mistaken belief that the emergency duties for them had been completed.

AT THE annual conference of the Television Broadcasters Association in New York recently, Com. Wiliam C. Eddy, U.S.N., Ret., declared that between fifty and one hundred thousand engineers, graduates of Navy courses in Radar and allied sciences will be available to the television industry once the war is ended. Com. Eddy disclosed that the Navy sends out five thousand electronic engineers every month for service in all parts of the world. That is certainly a lot of radiomen but if the television industry gets started after the war in the manner it now appears it will, they will nearly all be required to man the stations.

IN A recent report the House Naval Affairs Committee disclosed that more than 40,000 vessels were added to the U. S. fleet during 1944. The Navy now has more than fifty-six thousand vessels in service and construction of more tonnage is continuing at a rapid rate. The growth the Navy has made to its present strength is remarkable when one considers that four years ago it had less than six hundred ships. It seems as though, however, we should have had a larger Navy in the prewar days and also an adequate merchant marine to supply the Navy with its necessary materials. The neglect and decay of the American Merchant Marine during the years following the first World War and preceding the present conflict must never be allowed to happen again.

By letting our Navy supply ships, the merchant marine, be neglected we are inviting trouble. Twice we were fortunate enough and fast enough with our construction programs to overcome our lack of keeping an adequate merchant marine, but it may be next time we will not make the grade.

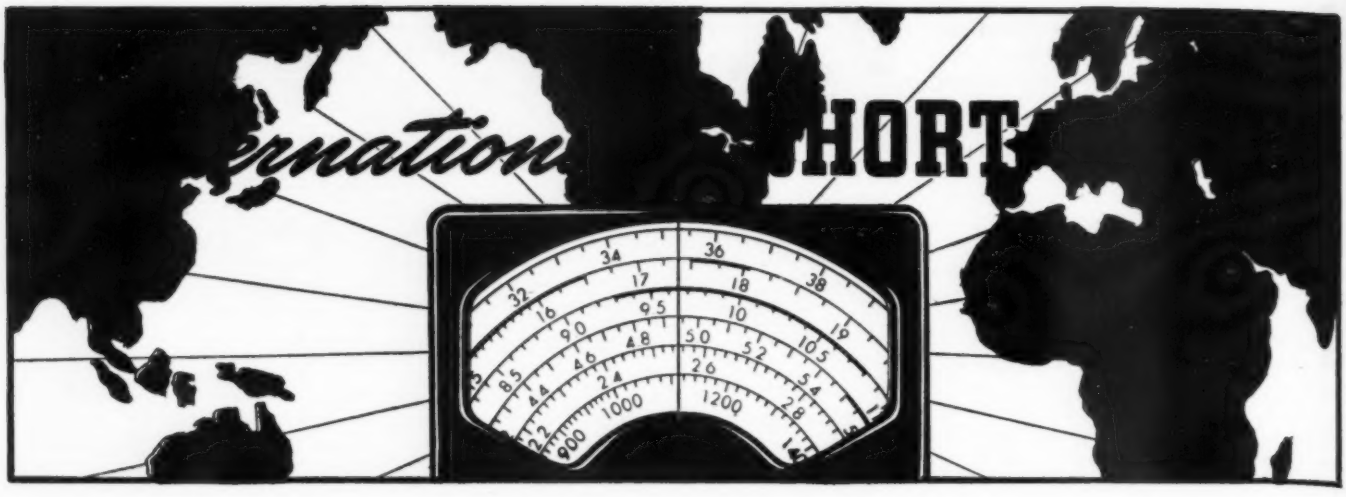
It's high time that the Government and people generally become merchant-marine-minded and do not allow our commercial shipping to rot away as it did after the last war in the various merchant fleet "graveyards."

This country will emerge from this war with the largest merchant marine in the world as it did after the last war and we must realize that it will lose that fleet to the more marine-minded nations unless we are on our toes. We must keep a wide-awake attitude towards a postwar program for a real merchant marine built on a solid foundation of sensible maritime legislation and we will find many changes necessary in maritime regulations which Congress should adopt in order to construct the base of a permanent merchant marine.

"Please sit down. I always have trouble with standing Waves!"

NEW draft regulations around the turn of the year appear to have sent quite a number of men in the industrial areas back into war posts. A rather large number of men had left war-industry jobs for what seemed to them to be more secure postwar positions. However, the draft boards are getting around to these things and have stepped up the demands for the Armed Forces about twenty percent. The War Department boosted its

(*Cont. on page* 153)



***Compiled by* KENNETH R. BOORD**

THROUGH the courtesy of Clayton Howard, chief engineer, HCJB, Quito, Ecuador, we are able this month to present details on the current operations of "The Voice of the Andes," one of the most widely-listened-to short-wave stations in the world.

Mr. Howard informs us that HCJB is operating four transmitters, as follows:

Frequency	*Power*
12.455 megacycles	10 kilowatts
9.958 megacycles	1 kilowatt
4.107 megacycles	1 kilowatt
974 kilocycles	1.5 kilowatts

The two highest frequencies are reported as heard more generally, says Mr. Howard, although occasional reports of reception on 73 meters are received from listeners in the United States.

On Central War Time, the 12.455- and 9.958-megacycle transmitters operate simultaneously from 6 to 9 a.m. each morning and from 2:30 to 10 p.m. each afternoon and evening, with the exception of Monday when the hours are 5-10 p.m. In addition, on Sundays there are programs from 9 a.m. to 12:30 p.m. and 1:30 to 2:30 p.m. On Sundays, Wednesdays, and Saturdays, the transmitters continue to 10:30 p.m. English programs include 6:45-7:30 and 8-9 a.m., daily; 2:30-3:30, 5-6:15, and 9:30-10 p.m. (or 10:30 p.m.), daily. All programs on 9.958 are beamed to the United States and the morning and evening programs on 12.455 to this country as well. From 2:30 to 5 p.m., the 12.455 transmitter is beamed to Europe. Twelve other languages are used during the week.

The 4.107-megacycle and 974-kilocycle stations operate together entirely in the Spanish language, 6:30-9 a.m. and 6-10 p.m., daily, with the addition of 9-9:30 a.m., 11 a.m.-12:20 p.m., and 5-6 p.m. on Sundays. No directional antennas are used on these transmitters.

(Complete schedules of HCJB are given in an accompanying table.)

"We presently are experimenting on 15.115 megacycles with a power of 1 kilowatt from 2:30 to 7 p.m., daily, and 6-9 a.m., daily, beamed to the United States," reports Mr. Howard. "We would greatly appreciate any reports on the reception of this frequency. As far as we know, we are the first station in this area to try 19 meters and so are very anxious for reports before deciding on a definite schedule. In a short time we hope to test on 49 meters, probably 6.240 megacycles, with bandswitching in our present transmitter setup."

* * *

NEW

Canada has completed one of its new short-wave stations, located at Sackville, New Brunswick, with the call letters CHTA, on the frequency of 15.22 megacycles, and 50,000 watts of power. The other station is not yet completed, but the call is reported to be CKNC on an expected frequency of 17.82 megacycles, with 50,000 watts of power. (Boehnke, California.)

(EDITOR'S NOTE: A late dispatch from Montreal, forwarded to us by Albert E. Bromley, Toronto, Ontario, tells that "This is Canada calling" will flash around the world in many languages when the new $1,200,000 short-wave station at Sackville begins full scale operations soon. The dispatch says "it will give Canada a global voice louder than any other on this continent and perhaps as loud as exists anywhere, in the opinion of CBC engineers." The first test broadcast went crackling through the ether December 21. The BBC listening post in London reported that the signal strength compared favorably with any received there. A daily schedule from 6:45 to 9:15 a.m. EWT has been beamed since December 26th in English, French, and German. Official opening of the station was set for late in January, so by the time this issue of RADIO NEWS reaches you, the station may be operating regularly.

By spring it is hoped to have all antennas completed, so that the transmissions will go out to South and Central America, Africa, the Antipodes, Asia, and to a less effective extent, the Far East. The Far East beam from Sackville must pass over the north magnetic pole, Number One saboteur of short-wave transmissions.

The European beam will be heard over several frequencies including CHTA [15.22 mc.] or CKNC [17.82 mc.]. CHTA and CKNC are two of the 11 call letters set aside under international agreement for Canada. Headquarters of international service for Canada are in Montreal. Programs are to be prepared and broadcast from there by land lines to Sackville, where they will hit the sky trails in waves which can circle the earth eight times a second. A goal of 13 hours broadcasting spread over the period between 4 a.m. and 11 p.m. is set for achievement by summer. Highest priority on the daily transmission will go to programs for Canadian troops in Europe, prepared and broadcast by returned Servicemen, the dispatch concludes.)

HCJB Quito, Ecuador, is experimenting on 15.115 megacycles, beamed to the United States with a power of 1 kilowatt, 2:30-7 p.m., daily, and 6-9 a.m., daily. Reports from listeners are requested by HCJB and should be addressed to Mr. Clayton T. Howard, chief engineer, Radiodifusoras HCJB, Quito, Ecuador, South America. HCJB expects to experiment shortly in the 49-meter band, probably on 6.240 megacycles.

KRHO is the call of the new transmitter in Honolulu, Hawaii, which broadcasts on 6.12 megacycles, full schedule being 4 a.m.-12 noon EWT, beamed to Japan, China, Korea, Manchukuo, and Formosa; signal is strong on the West Coast. English news is heard on the hour. (Balbi, California.) Reception of KRHO has also been reported by one listener in the East to date.

United Network stations in San Francisco added for 1945 include the following:

KNBI, 15.13, 8 a.m.-6:30 p.m.; 7.80, 6:45-10:05 p.m.

KNBX, 11.89, 8-10:30 a.m.; 21.54, 10:45 a.m.-3:30 p.m.; 11.89, 3:45-8:30 p.m.; and 9.49, 8:45-10:05 p.m.

KCBA, 15.27, 2-5:30 p.m.; 6.19, 5:45-11 p.m.

KCBF, 11.79, 2-8:30 p.m.; 6.38, 8:45-11 p.m.

JBC is the call of the Batavia, Java, station, now being heard 9-10:33 p.m., with news in English at 9 and 10:15 p.m. (Balbi, California.) Also reported to come on at 6:30 a.m.

XYYU, 9.60, Mexico City, is heard irregularly to 1 a.m. (Balbi, California).

A Buenos Aires, Argentina, station, announced frequency, 18.115, has been heard since late in November from 5:55 to 6:15 p.m. signoff. Gives talks in English, chimes identify. Exact call unknown.

VLC6, 9.615, Shepparton, Australia, now has news in English both at 11 and 11:35 a.m. (Harris, Mass.).

A station believed to be EQB, Tehe-

ran, Iran, is reported as heard on 6.155, after 9:45 a.m., with native music and speech.

WVLC, 7.800, Leyte, Philippines, is an excellent catch, heard with news dispatches, network broadcasts, 7-10 a.m., irregularly. (Woolley, Colorado).

A new station on 3.450 at Johannesburg, Union of South Africa, is reported to broadcast in Afrikaans, 11:30 a.m. or 12:30 p.m. to 5 p.m. On 4.895 Johannesburg is reported heard in Afrikaans, 12:45-2:30 a.m. and 10 a.m.-12:30 p.m. Has anyone picked up Johannesburg on these or any other frequencies?

* * *

CHANGES

The latest schedule of Radio Dakar in French West Africa is reported as 11.405, 2:45-5:15 p.m.; 8.84, the same; 7.21, 2:24-3:45 p.m.; and 6.917, 3:50-5:15 p.m. (Boehnke, California).

XGOY, 6.17, changed on January 2, to 6.135 mcs. (Balbi, California).

Radio Shonan (Singapore) on 15.45 now has two transmissions beamed to the United States—6-7:30 p.m. to East Coast, and 8-8:40 p.m. to West Coast (Balbi, California).

TGWB, Guatemala City, Guatemala, has moved to 6.46 mcs. from 6.48 mcs.; schedule, 7 p.m.-2 a.m. (Balbi, California).

ZNR, Aden, Arabia, 6.760, since December 6, has been broadcasting on this new additional frequency in parallel with 12.115 from 12:15 to 1:25 p.m. English, Hindustani, and Somali are used. The 12.115 frequency is sometimes heard as early as 11:45 a.m.

Radio Andorra on 5.985, is reported as being heard now as early as 4:30 p.m. to signoff at 7:30 p.m. A woman does most of the announcing, with Spanish identification.

LSX, Buenos Aires, 10.350, is heard irregularly, 7-7:15 p.m., with talks in English. Identifies in English as LQA5 but announces several other calls in Spanish. Signoff is usually about 7:40 p.m. Good signal.

VLC8, 7.280, Shepparton, Australia, is now off, 12:15-12:45 p.m. Replaced by VLC2, 9.680 on this beam to Britain (Balbi, California).

VE9AI, 6.005, Edmonton, Alberta, Canada, has changed its schedule to 8:15-10:15 a.m., 8 p.m.-2 a.m., with news in English at 1 a.m. On 9.540, VE9AI is schedule now from 10:15 a.m. to 5 p.m. (Balbi, California).

XPSA, Kweichow, China, has moved to 7.010 from 6.990, heard now as late as 11:30 a.m.

XGCA, Kalgan, China, on 9.625, is being heard again in the East with a good signal, 7-8:45 a.m.

The present frequency of XGRS, Shanghai, China, is 11.685; heard daily in English, 7:15-8 a.m.

HJEB, Manizales, Colombia, has returned to 6.105 from 6.225.

HI3U, Santiago de los Caballeros, Dominican Republic, has moved to 5.985 from 6.015.

The British Mediterranean Station on a new frequency of 6.135, located in Jerusalem, Palestine, has news at 4 p.m. On 7.215, this station has English news at 12:45 and 4 p.m. On 9.670, has news at 12:45 p.m. and 1 a.m. On 11.720, has news at 1 a.m.

PIRN, 6.140, Japanese-controlled station in Manila, Philippines, is using more English than previously; news heard at 7:30 and 8:45 a.m., with signoff at 9 a.m. now. PIRN on 15.320 now opens at 7 p.m. with an all-English program; first news is at 7:15 p.m., with POW messages at 7:30 p.m.; signoff is at 9 p.m.

* * *

BEST BETS FOR BEGINNERS

PACIFIC COAST AREA—We have just received the following list of best bets for beginners on the Pacific coast from Charles C. Boehnke, San Francisco (PWT):

PROGRAM	TIME (EWT)	STATION AND FREQ.
News in Turkish	5:45 a.m. daily	TAQ, 15.195
News in Turkish	6:15 a.m. daily	TAQ, 15.195
News in Urdu	11 a.m. daily	TAP, 9.465
News in Serbo-Croat	11.15 a.m. daily	TAP, 9.465
News in Arabic	11:30 a.m. daily	TAP, 9.465
News in Persian	11:45 a.m. daily	TAP, 9.465
News in Turkish	12 noon daily	TAP, 9.465
News in Greek	12:15 p.m. daily	TAP, 9.465
News in Bulgarian	12:30 p.m. daily	TAP, 9.465
News in French	12:45 p.m. daily	TAP, 9.465
News in English	1 p.m. daily	TAP, 9.465
Radio-Gazette in Turkish	1:15 p.m. daily (Except Sunday)	TAP, 9.465
Special broadcast to England	4:30 p.m. Thursday	TAP, 9.465
Special broadcast forDXers the world over	4:30 p.m. Sunday	TAP, 9.465

In addition to the above, TAP, 9.465, is reported as heard daily at 4:30 p.m. New transmissions are being built by Radio Ankara, with initial broadcasts to be made shortly.

News bulletins presented by stations TAP, 9.465 mc., and TAQ, 15.195 mc., Radio Ankara. Special broadcasts are presented in various languages.

YV5RN, 4.92, Caracas, Venezuela, 6:30-8:30 p.m.

OAX4Z, 5.895, Lima, Peru, 6-9:30 p.m.

VUD-3, 6.19, Delhi, India, 5-7 p.m.

GRM, 7.12, London, signs on at 9 a.m., usually fades out around 9:50 a.m.; beamed to Near East.

JVW, 7.257, Toyko, 8-11:40 a.m.

GSU, 7.26, London, 7-9:45 p.m.

VUD-2, 7.29, Delhi, India, 6-7 p.m. with news in English at 6:45 p.m.

COCQ, 8.83, Havana, Cuba, 4-10:30 p.m.

Radio Brazzaville, 9.44, Brazzaville, French Equatorial Africa, 2-5:48 p.m.

JZI, 9.535, Tokyo, 8-11:40 a.m. and 8 p.m.-1 a.m.

(*Continued on page* 84)

Complete schedule of "The Voice of the Andes," HCJB, Quito, Ecuador, S. A.

FREQ.	LANGUAGE	TIME (CWT)	BEAM*
12.455 mcs. and 9.958 mcs.	Portuguese	6-6:45 a.m. daily	U. S. and Brazil**
	English	6:45-7:30 a.m. daily	U. S. and Brazil**
	Spanish	7:30-8 a.m. daily	U. S. and Brazil**
	English	8-9 a.m. daily	U. S. and Brazil**
	English	9-11 a.m. Sunday	U. S. and Brazil**
	Spanish	11 a.m.-12 noon Sunday	U. S. and Brazil**
	Arabic	12-12:20 p.m. Sunday	Arabia
	Spanish	1:30-2 p.m. Sunday	Europe
	English	2-2:30 p.m. Sunday	Europe
	English	2:30-3:30 p.m. Sunday and Tuesday through Saturday	Europe
	French	3:30-3:45 p.m. Tuesday through Saturday	Europe
	Dutch	3:45-4 p.m. Tuesday through Saturday	Europe
	Russian	4-4:15 p.m. Sunday and Tuesday through Saturday	Europe
	Swedish	4:15-4:30 p.m. Tuesday through Saturday	Europe
	Swedish	4:30-5 p.m. Sunday and Tuesday	Europe
	French	4:30-5 p.m. Wednesday	Europe
	Czech	4:30-5 p.m. Thursday	Europe
	Dutch	4:30-5 p.m. Friday	Europe
	Italian	4:30-5 p.m. Saturday	Europe
	English	5-6:15 p.m. daily	United States
	Spanish	6:15-9:30 p.m. daily	United States
	English	9:30-10 p.m. daily	United States
	English	10-10:30 p.m. Sunday, Wednesday, and Saturday	United States

*This applies to 12.455 mcs. only; 9.958 mcs. is constantly beamed on the U. S. during transmissions. Reports indicate that programs beamed from HCJB on Europe and Arabia are generally heard well throughout the United States.

**Bidirectional.

News from OVERSEAS

By KENNETH R. PORTER
RADIO NEWS War Correspondent

News items emanating from military and civilian sources located in the European Theater of Operations.

Splicing a heavy phone cable in a telephone exchange located somewhere on the Western Front.

REGARDLESS of the foresight with which all airborne radio equipment is planned, designed, and built by service organizations and private industry, it is, nevertheless, found necessary from time to time to improve, modify, or supplement such equipment in the field to suit specific combat requirements or to avoid dangerous bottlenecks from impeding military operations.

For this purpose, a radio laboratory recently was established in this theater and assigned the task of tackling all major airborne radio problems which are beyond the scope of ordinary air service command depots and field maintenance/repair shops.

This laboratory is unique of its kind, equipped with the most up-to-date instruments and staffed by selected radio experts of long years of experience. Attached to it is a complete machine shop where intricate and precise parts and components can be made experimentally at short notice.

In the short time of its existence, this laboratory already has helped to keep thousands of combat planes from being grounded for lack of communications as well as saved American taxpayers many millions of dollars in working out a variety of devices for the reconditioning of salvaged radio equipment.

* * *

At one time a critical shortage of radio crystals threatened to ground radio-equipped fighters and bombers and delay the carying out of important operations.

T/Sgt. James T. Johnson of the Radio Research Department, ASC, US AAF, a 22-year old peacetime radio technician from Weatherford, Texas, broke the bottleneck by inventing in 30 days a testing device by the application of which some 20,000 damaged crystals (each one of them represents $35.00) were made serviceable again.

This instrument incorporates a cathode-ray tube and employs a crystal of known frequency for the determination of the exact frequency of salvaged crystals as well as their ability to withstand the vibrations of a plane in flight.

The Crystal Tester is being widely adopted by U.S. and RAF airborne radio equipment repair and maintenance depots all over the world.

* * *

SHAEF recently released information about the u.h.f. relay system which was worked out to the minutest detail somewhere along the Eastern Coast of the United States prior to the Allied invasion.

Unknown to the millions of people living in the area, a topographical replica of the invasion terrain was mapped out there and tests carried out with radio relays, 25 to 100 miles apart, from which carriers were beamed on a course like rifles on a target.

These preinvasion rehearsals en-

Signal Corps linesman swings across on a shaky cable, over a raging river in France.

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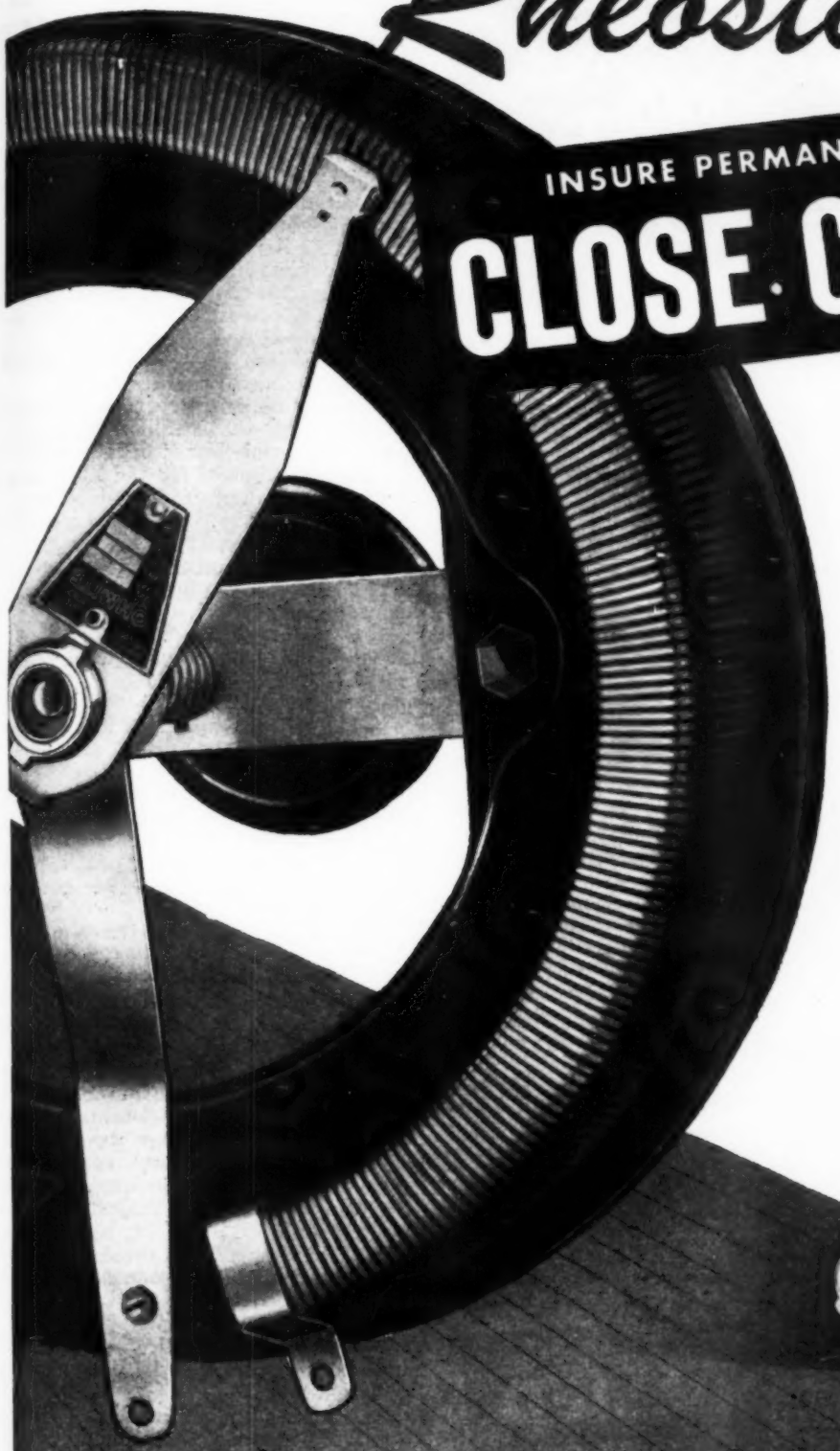

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abled the U.S. Army Signal Corps to keep in step with the armored columns moving so rapidly as to be at times many miles ahead of their wired communications.

* * *

According to a report, a new type of remote-controlled tank has been used for some time past by the Germans which, it is claimed, constitutes the latest addition to Germany's long-range retaliation weapons.

Described as V-4 and equipped with smoke-screen throwing apparatus controlled by radio, this tank appears to be the big brother of the German dwarf tank "Goliath" used at one time unsuccessfully at Anzio.

* * *

The recent liberation of the Dutch town of Eindhoven, the home of the Philips radio works, revealed that despite the confiscation of their receivers, Dutchmen managed to listen-in to BBC and other transmissions.

Clandestine sets were almost mass-produced by the Philips workers in their spare-time out of parts and components earmarked for the Luftwaffe.

These sets, detectors, detector/amplifiers, and one or two-valve straight receivers all housed in biscuit boxes, were smuggled out of the factory by night and distributed throughout the country by patriots.

* * *

The tremendous wartime development of radio is bound to affect not only postwar British broadcasting in general, but also may lead to a change in the present structure of this country's broadcasting stations.

The BBC's monopoly appears to be shaken and a good deal of speculation is going on here whether or not commercial broadcasting, as practiced in the United States, will be adopted after the war.

This is due to the fact that the British Government is anxious to prevent the prewar practice of "buying time" on Continental radio stations by advertisers, which cost the country many millions annually.

At the same time, however, an influential part of the public maintains that the introduction of sponsored radio programs would destroy the national character of the present system, retard the progress of broadcasting and be ill-received by the majority of the population.

It is anticipated that the controversy will gain impetus as soon as wartime controls are removed.

* * *

Wireless receiving licenses have increased by a quarter of a million in the past year.

The total number of such licenses for Great Britain and Northern Ireland is now 9,600,000.

* * *

Throughout five years of war, the BBC never ceased broadcasting.

Transmissions regularly came on the air and went off without interruption because a master switch enabled during air-raids the instantaneous switch-over from the London station to re-

Radio and electronic products built by Delco Radio are serving in every theater of war . . . helping to coordinate the action of all units of the armed forces. Good performance is essential. Dependability must be insured under extreme conditions of service. These characteristics are attained through Delco Radio's effective combination of engineering vision, manufacturing precision. Delco Radio Division, General Motors Corporation, Kokomo, Indiana.

KEEP BUYING WAR BONDS

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gional stations dispersed all over the country.

These regional stations were carefully camouflaged and connected with temporary studios located in churches, schools, public houses, etc.

* * *

Several British manufacturers have completed plans calling for the production of automatic home talking movie outfits costing approximately $140.

With the aid of these outfits, it will be possible to reproduce pictures on a screen measuring 4 feet square with perfect sound effects.

* * *

Short-wave relaying was used by the Cable and Wireless Company to restore at short notice the London-Paris radiotelegraph link.

The route went via the automatic relay stations at Ascension or Barbados as the 4 mcs. band frequency of Paris was unsuitable for night traffic.

-30-

CALIBRATION TEAMS

ARMY Ordnance calibration teams in Italy and Germany are employing new electronic equipment to increase the accuracy and to extend the battle usefulness of American heavy artillery. The new equipment, which can be installed in a 2½-ton Army truck and transported right up to the battlefront, is capable of measuring the speed of projectiles within 1/100,000ths of a second.

It is always a difficult problem to get a projectile squarely on the target at ranges up to 17 miles. Involved in this operation are such factors as the age of the gun, the quality of the ammunition, the curvature of the earth, and such additional factors as wind, temperature and barometric pressure. These constantly changing factors necessitate complex calculations and the use of the most modern scientific devices in order that the highest degree of firing accuracy may be obtained.

A recent Ordnance scientific mission, headed by Colonel Leslie E. Simon, Chief of the Ballistic Research Laboratory, Aberdeen, Maryland, travelled 160 miles with Lieutenant General Mark Clark's Fifth Army in Italy where they actually calibrated guns that were being fired on enemy targets.

Colonel Simon's team calibrated all types of heavy artillery weapons. The problem was to determine the velocity or speed of the projectiles of guns and howitzers that had been in service for several weeks or months, as compared with the velocity of new artillery pieces in action for the first time. Old guns and howitzers cannot shoot as far as new weapons.

Obviously when guns of different ages are being fired together in battery at the same target, allowances have to be made for each used gun.

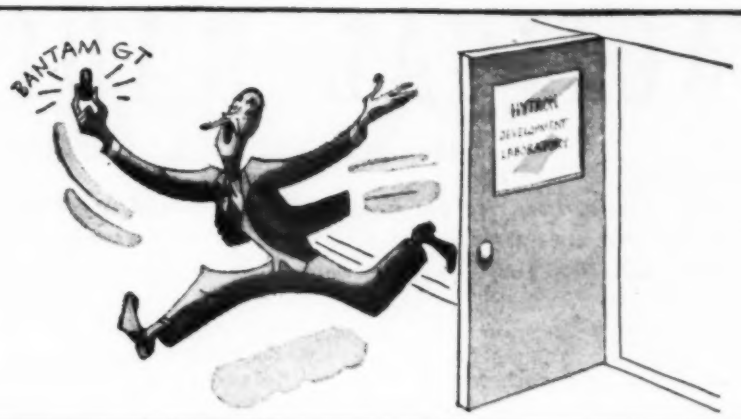
This scientific work demonstrated that the life of gun tubes is much longer than previously assumed. Gun crews, in the past, discarded gun tubes rather frequently because they had no way of knowing the maximum efficient life of a tube and could not afford to take chances when the lives of our Infantrymen were at stake.

-30-

they said

it couldn't

be done . . .



and again . . .

THEY SAID

IT COULDN'T

BE DONE . . .

Hytron's telescoping of receiving tubes to BANTAM GT size was at first considered impracticable. Development of the BANTAM JR. was another impossibility to be proved possible. This first sub-miniature was a tiny tube whose diameter was about that of your little finger — and it was a pentode at that! As a production tube it just didn't seem to make sense.

Encouraged by hearing-aid manufacturers eager to gain the additional sensitivity of the vacuum tube, Hytron sweated it out for two long years. Operators were trained to assemble the minute parts under magnifying glasses. A simple reversal of the conventional stem made baseless tubes possible. Problems of obtaining suitable vacuum with such small bulbs, were licked.

Finally in 1938, Hytron introduced the first successful sub-miniature. Tiny but rugged despite a hair-like filament and a diminutive mount structure, its low current drain and compactness made the BANTAM JR. a natural for all kinds of portable equipment, hearing aids, and military electronic devices. After the war, watch for even smaller and better Hytron subminiatures.

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PRACTICAL RADIO COURSE

By ALFRED A. GHIRARDI

Part 32. Covering the local oscillator employed in superheterodyne receivers, including the operation of the oscillating tank circuit and an explanation of why the vacuum tube is necessary if sustained oscillations are to be produced.

IT WILL be remembered from our previous discussions of receiver principles that the superheterodyne type of receiver employs a local oscillator to generate an unmodulated r.f. signal. This is fed to the mixer or frequency converter, where it acts with the incoming modulated carrier signal admitted by the preselector tuned circuits, to produce at its output circuit (among others) a *similarly modulated* signal of specially chosen new frequency known as the *intermediate frequency* (i.f.)[1]. The frequency of this local oscillator signal must always be adjusted to a value such that it differs from the frequency to which the preselector circuits are tuned, by an amount equal to the i.f. employed in the receiver.

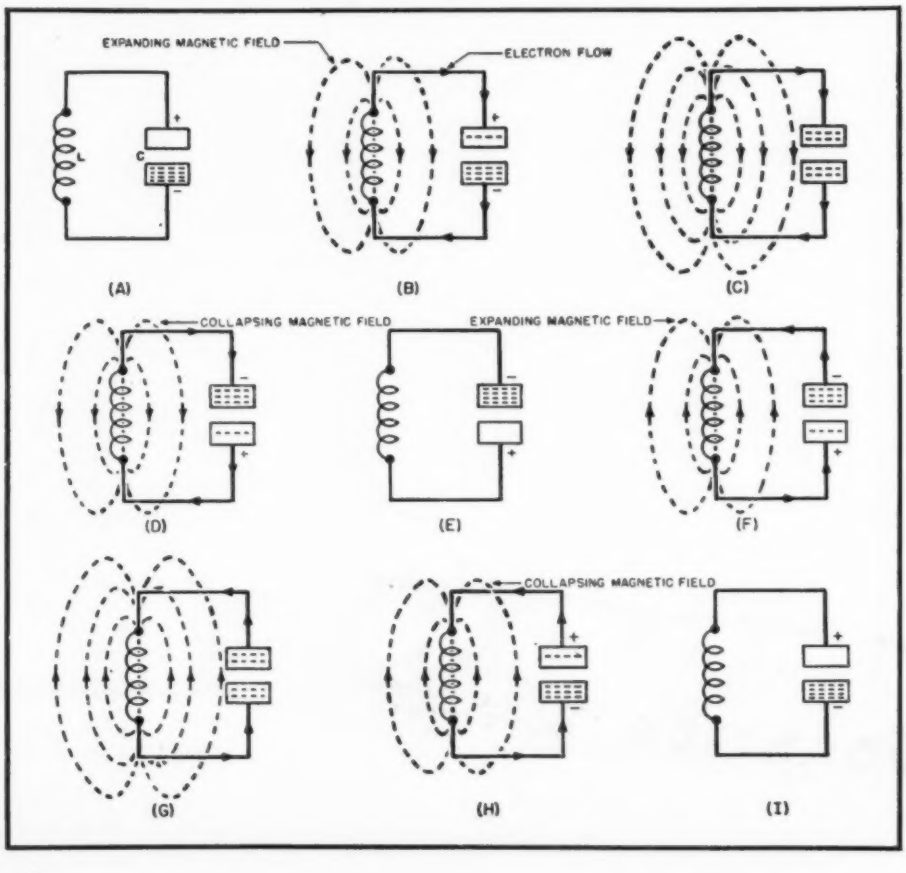
It is obvious that the local oscillator and its signal output play a very vital part in the operation of the superheterodyne receiver. Although it is comparatively simple in itself, the stringent operating requirements imposed upon it by modern superheterodyne receiver design practice make the oscillator one of the major design problems in the receiver. Consequently, because it is important that its theory of operation, practical circuit arrangements employed, and the operating characteristics demanded of it be thoroughly understood, we will digress from our study of the superheterodyne receiver in this and the following lesson to discuss the fundamentals of the types of vacuum-tube oscillators commonly employed in such receivers.

Since the simple oscillating "tank" circuit forms the very heart of the vacuum-tube oscillator, its operation will be studied first. Then its combination with a vacuum tube operating as an amplifier will be considered.

The Simplest Type of Oscillating Circuit

The parallel combination of an inductor, L, and a capacitor, C, as illustrated at (A) of Fig. 2, constitutes an electric circuit in which an oscillating current flow may be set up under certain conditions. Once it is "started" by the application of a voltage pulse (such as might be electromagnetically induced into L by another current-carrying coil placed near it, as shown at [B]), a circulating alternating current flow of a frequency for which $X_L = X_C$ will be set up in it. This circulating current flow is caused by the repeated exchange of energy between the magnetic field of the inductor and the electrostatic field of the capacitor, as we shall now see.

Fig. 1. How an alternating-current flow is set up in the tank circuit by the alternate exchange of energy between the capacitor and inductor.



How the Simple Oscillating Tank Circuit Operates

Assume that a single current pulse is caused to flow through tickler coil L_1 placed in inductive relationship with coil L, and that this induces in the latter a voltage pulse that makes the top terminal of L positive and the bottom terminal negative—as illustrated in (B) of Fig. 2. Because coil L is connected directly to the capacitor, this voltage pulse causes electrons to flow (current) from the *upper* plate of the capacitor, around through the connecting wires and coil, and into the *lower* plate, as illustrated at (C). The upper plate then becomes deficient in negative electrons, and so assumes a *positive* charge; simultaneously, since the lower plate has accumulated an excess of negative electrons it becomes *negatively* charged—as illustrated in (C). The electron flow diminishes as the charge, and potential difference between the plates, builds up and opposes the charging potential.

Assume now that the energizing current in tickler coil L_1 is stopped and the coil is removed. We have then, a charged capacitor, C, connected directly across an inductor, L, as illustrated at (A) of Fig. 1. (In this illustration the capacitor plates have been drawn in a manner that indicates their function as reservoirs for electrons, and the negatively charged electrons in them are indicated by small negative signs.)

The following important cycle of events, illustrated by the individual diagrams in Fig. 1, now takes place:

(1) Electrons begin to rush out of the overcrowded negative (lower) plate, flow around through the connecting wires and the inductor, and into the positive (upper) plate, as illustrated in (B). The flow of these

[1] For a detailed explanation of this process refer to Figs. 1 and 2 and accompanying text on pages 72 and 74 of Part. 26 of this series in the September, 1944, issue of RADIO NEWS.

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electrons through the turns of wire comprising the inductor creates a magnetic field around it; this field tends to oppose the action of the electrons (Lenz' law).

(2) As electrons continue to flow out of the lower plate of the capacitor and around through the inductor into the upper plate, the magnetic field around the inductor expands. A condition is finally reached, (*C*), where each plate contains the same quantity of electrons.

(3) Ordinarily the electron flow would cease at this instant because the electric charges on the two plates are equal, i.e., the capacitor is electrically "neutral." However, when the rate of flow of electrons through the inductor diminishes toward zero, the magnetic field around it begins to collapse, thereby cutting the turns of the coil and inducing in it an e.m.f. which acts to keep the electrons flowing around through the circuit in the same direction toward the upper plate of the capacitor. This is illustrated at (*D*). This e.m.f. forces an excess of electrons into the upper plate, thereby charging it *negatively*. By the time the field has completely collapsed, all the energy which was stored around the inductor in the form of a magnetic field will have been converted into an equivalent amount of electrical energy (neglecting circuit losses) in the form of an electrostatic field in the charged capacitor. The action of the collapsing magnetic field in carrying the circuit past the electrically "dead" point illustrated at (*C*) is commonly termed the *flywheel effect*, for it acts just as an engine flywheel does in carrying the engine past "dead" center.

(4) The charged capacitor now begins to discharge, sending electrons out of its upper (negative) plate around through the turns of the inductor to its lower plate, as illustrated at (*F*). Notice that, the directions of both the electron flow and the resulting magnetic field around the inductor now are opposite to what they were during the previous capacitor discharge.

(5) Again, when the charges on the two plates of the capacitor approach equality and the rate of flow of electrons through the inductor diminishes toward zero, see (*G*) of Fig. 1, the magnetic field around it collapses, inducing in it an e.m.f. which acts to keep the electrons flowing so they charge the lower plate of the capacitor negatively, as illustrated at (*H*). By the time the field has completely collapsed, as shown at (*I*), the capacitor will be charged. This completes the cycle of events.

(6) The capacitor now discharges through the inductor again, as at (*B*), and the cycle repeats itself.

It is evident that two pulses (one complete cycle) of *alternating current* flow through the tank circuit during each such complete cycle of events. This is illustrated at (*A*), of Fig. 3. The points *A*, *B*, *C*, etc., on the graph


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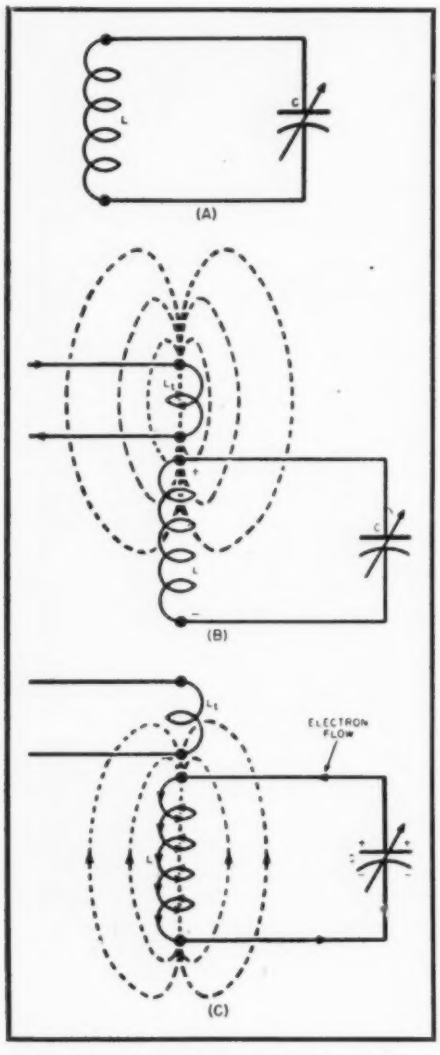


Fig. 2. Explaining the action of the tuned (tank) circuit in which oscillations are set up. The frequency of oscillation depends upon the value of L and C.

indicate the magnitude and direction of current flow that exist during the respective circuit conditions depicted, by corresponding illustrations (*A*), (*B*), (*C*), etc., in Fig. 1.

Examination of the various illustrations in Fig. 1 will reveal the fundamental principle of the oscillating tank circuit to be as follows: *the alternating or oscillating flow of electrons (current) back and forth through the circuit is caused by the repeated exchange of energy resulting from discharge of the capacitor through the inductor (thereby building up a magnetic field around it), followed by collapse of the magnetic field of the inductor, which results in charging the capacitor again and returning the circuit to its original electrical state so it can repeat the cycle of events.*

The important accomplishment of the oscillating circuit is that through its use a pulse of electrical energy injected into the circuit may be converted into a flow of alternating current whose frequency may be easily controlled by proper selection of the inductance and capacitance of the circuit elements.

Frequency of Oscillation

The current impulses flowing back and forth through the tank circuit occur a definite number of times per second.

The total number of complete (back and forth) current oscillations that occur each second is known as the *frequency of oscillation* (*f*). This frequency naturally depends upon the values of inductance and capacitance present in the circuit, since these determine the time required for the capacitor to charge and discharge and for the field of the inductor to build up and to collapse twice during each cycle. The frequency is really the *resonance* frequency of the inductance-capacitance combination, i.e., the frequency for which the reactance of the inductor is numerically equal to

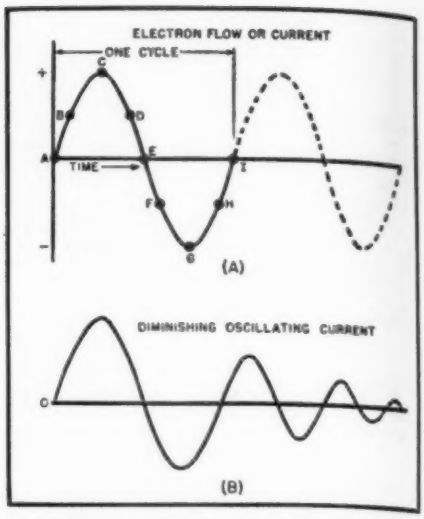


Fig. 3. Representing the theoretical and actual current flow in the tank circuit.

the reactance of the capacitor ($X_L = X_C$).

Since $X_L = 2\pi fL$, and $X_C = \frac{1}{2\pi fC}$

we have: $2\pi fL = \frac{1}{2\pi fC}$

from which: $4\pi^2 f^2 = \frac{1}{LC}$, or $f^2 = \frac{1}{4\pi^2 LC}$

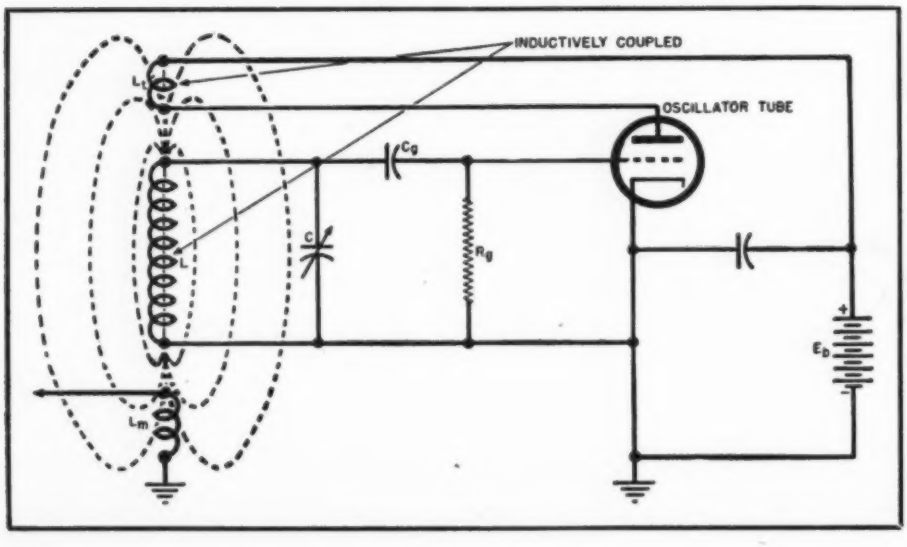
and $f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{6.28\sqrt{LC}}$

where: f = frequency in cycles per sec.
L = inductance in henries
C = capacitance in farads

Effect of Resistance in the Tank Circuit

It would seem as though once the oscillating tank circuit action is "started" by the application of electrical energy in the form of a voltage pulse introduced into the circuit in some manner, the tank circuit would have set up in it a sustained alternating-current flow of constant magnitude. Actually, the oscillating pulses of current would repeat themselves undiminished in strength indefinitely (as shown at [A] of Fig. 3) if it were not for the fact that actual tank circuits must necessarily be constructed of real physical components (the inductor, capacitor, and circuit wiring) that offer *resistance* to the flow of electrons through them. Consequently, as each pulse of current flows around through the circuit, some of the electronic energy is dissipated in overcoming the total resistance of the circuit. Therefore, each succeeding current pulse is weaker than the previous one (see [B] of Fig. 3); the high-frequency resistance of the circuit determines how much the decrement is and how soon the oscillating current dies down to zero value. This dissipation of the electrical energy gradually consumes the original impressed energy. If we attempt to connect a load to the tank circuit for the purpose of extracting some of its energy for useful utilization in an external circuit or device, the oscillating

Fig. 4. Basic grid-tuned oscillator circuit of the tickler feedback type. The tube permits sustained oscillations to be produced. Coil L_m is used to couple the oscillations of the tank circuit to any external load by means of inductive coupling.



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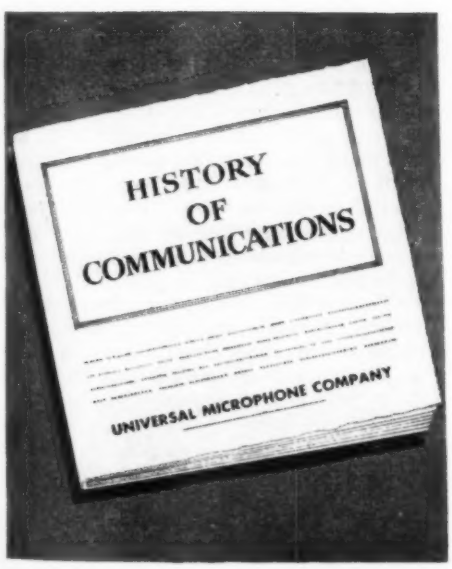

Today the allied military radio equipments represent the "tops" in engineering design. Progress from the spark transmitter of World War I to present-day equipment is, indeed, a far cry. Taking up where they left off December 7, 1941, Universal Engineers, with their added experience with precision military equipment, shall produce for the public, electronic devices not of fantastic design – but of proven utility and quality.

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current will die out even more quickly because the energy in the tank circuit will then be consumed more rapidly.

Why the Oscillator Needs a Vacuum Tube

It is apparent that a simple tank circuit alone does not constitute a practical source of constant-amplitude alternating current—an oscillator. We must supplement the tank circuit with some device that will supply sufficient energy to it in correctly *timed* and *phased* impulses to replace the energy losses in the tank circuit itself plus the energy extracted from it.

The Vacuum-Tube Oscillator

The ordinary vacuum tube operated as an amplifier is the only practical device yet developed for applying the charging voltage to the tank circuit at the proper instant (or instants) during each cycle, since in radio-frequency oscillators this must be performed many times—sometimes many million times—per second. When operated in this capacity the tube is said to be functioning as an *oscillator*. The combination of oscillator tube, tank circuit, and necessary accessory equipment actually comprise the complete *vacuum-tube oscillator*.

It should be remembered that the tank circuit is the *basic* element which produces the alternating (oscillating) current; the vacuum tube and power supply are added to it merely to make it deliver a.c. of constant amplitude. The vacuum tube acts to control the application of supplementary energy to the tank circuit in correctly timed and phased impulses; the power supply furnishes the power requirements of the *entire* circuit (including the power consumed by the tube itself).

Tickler-Feedback Oscillator Circuit

This basic idea is incorporated in the simple tuned-grid tickler-feedback type of oscillator circuit shown in Fig. 4, and credited to Major Armstrong of FM fame. Our simple oscillating tank circuit (L, C) has been inserted between the grid and cathode of an ordinary triode amplifier tube (together with a grid-blocking capacitor C_g and grid-leak resistor R_g whose functions will be explained later). A small coil L_t (known as the "tickler" coil), placed in inductive relationship with L, is connected in series with the tube's plate circuit.

This simple oscillator circuit is capable of producing sustained oscillations in the tank circuit. When a coil L_m is inductively coupled to tank coil L, it will absorb some of the oscillating energy from the tank coil, thereby making this energy available for useful purposes in some external circuit or device. Besides functioning as a sort of "trigger" control which feeds energy into the tank circuit at correctly timed intervals, the vacuum tube also supplies some amplification.

(To be continued)

SPRAGUE TRADING POST

A FREE Buy-Exchange-Sell Service for Radio Men

THREE STAR PERFORMANCE!

Note that the Sprague Army-Navy E Flag now contains *three* stars. These stars, coupled with the original flag presentation means FOUR separate citations for outstanding service in supplying Sprague Capacitors and Koolohm Resistors to match the exacting demands of the nation's armed forces.

Such a fact explains better than words why it has sometimes been impossible to meet all civilian needs for these products. But it also shows beyond question of doubt that, whenever you can obtain them, you can rely on Sprague Capacitors and Koolohm Resistors for the utmost in service and dependability!

Ask for them by name. We'll appreciate it!

WILL TRADE automatic record changing unit (only slightly used) for portable recorder and phonograph. Balance in cash if any. Want used phono records, also worn out radios with good transformers, chokes, or tubes, also push-pull trans. Send list. P. W. Hoover, 907 Lippert Rd. N.E., Canton 4, Ohio.

FOR SALE—Triplett 1175B combination all-wave sig. generator and all-purpose V-O-M (known as NRI set analyzer), $65. Same as new with instructions. William Houchin, 17121 Cataldo Ave., Greenacres, Wash.

TUBES FOR SALE—6C5; 6SA7; 6SK7; 12SK7; 12SQ7; 50L6; 80, etc., also instruments and supplies. John Trowbridge, 7936 Parnell, Chicago 20, Ill.

WANTED — Tube tester and set tester combined; also 50L6; 35L6; 12SK7; 12SQ7; 35Z5; 1A7 tubes, GT or G. Have a few tubes for sale. Gene's Radio Shop, 923 Tazewelle Ave. S.E., Roanoke 13, Va.

WANTED — Oscillatone code oscillator and vibraplex "200" bug. Cash. Must be good. Pvt. F. L. England, Co. A, 229th Bn. I.T.B., Camp Blanding, Fla.

FOR SALE—Hickok sig. generator #170X, A-1 condition, designed for AM and FM; also Superior 1240 tube tester to test all late types. Paul Chinn, 92 N. High St., Columbus 15, Ohio.

WANTED FOR CASH — One 117P7 or 117L7 tube. Cpl. Clifford Schleasner, Sec. B, 842nd NTS, Hondo, Texas.

WANTED—Tube tester, signal generator, and voltohmmeter. Cash. Edward S. Hill, Woodmen, Colo.

WANTED—AC-DC wide range high resistance and voltage V-O-M, sensitivity 5000 ohm-per-volt or more. Must be A-1. Also other types of test eqpt. Cash. Joseph Jurin, 347 Scribner Ave. N.W., Grand Rapids 2, Mich.

FOR SALE—#60 Majestic chassis with good tubes & almost new speaker; also 1st i-f transformer for model 60 chassis. Ellis Smithberger, 233 Oakwood Ave., Marietta, Ohio.

FOR SALE — Auburn de luxe amplifier #XP-15861, $25; also Karenola Recorder & record player in heavy leather case, $40. Walter Kohler, Syosset, L. I., N. Y.

URGENTLY NEEDED—Howard pre-amplifier type 650 with type 655 loop kit (4 separate loops, L14, L13, L12, and L11); also RME LF-90 low frequency inverter. H. H. Piper, Truitt Ave., Milford, Dela.

IF YOU APPRECIATE the Sprague Trading Post service—and hundreds of radio men have told us that they do—we know we can count on you to ask for SPRAGUE CAPACITORS and SPRAGUE KOOLOHM RESISTORS by name, and to insist on getting them whenever they are available. They will not let you down!

TUBES WANTED—State quantities and prices. L. Stein, 7 Monroe St., Mt. Vernon, N. Y.

WILL TRADE a quantity of hard-to-get tubes at 30% from list for a 20-gauge Winchester pump gun in A-1 condition. Wentz Radio Service, 1215 W. State St., Olean, N. Y.

WANTED—Supreme #504-A tube & set tester; Superior #710; Readrite #710-A. Also want 50L6, 35Z5, 12SQ7, 12SK7, and 12SA7 tubes. Seymour Welsman, 1143—43rd St., Brooklyn, N. Y.

WANTED—Radio sig. generator in good condition. Describe fully. Cash. J. L. Dean, 23 East Ave. K, San Angelo, Texas.

WILL SWAP 8" PM Cinaudagraph speaker. Will swap 24, 35, 47, 80, 6C6, 6D6, 25B8, 70L7 tubes for 6V6, 6SC7, 25L6. Want an FM tuner, also AM tuner, also 12" hi-fi PM speaker and good 78 rmp phono motor. Herbert Jacobowitz, 1412 Franklin Ave., Bronx, New York 56, N. Y.

TUBES WANTED — 4-3S4; 1-1R5; 1-25L6; 2-12SR7; 1-12SK7; also want service manuals and test eqpt. L. C. Woodard, Robins Terrace "B," Warner Robins, Ga.

WILL SELL OR TRADE Supreme #85 tube tester. Want voltmeter or volt-ohmyst, also service oscillator. Horace L. Eudy, 1209 Louise Ave., Charlotte 2, N. C.

URGENTLY NEEDED—New 1R4 miniature tube. Eugene Zimmer, 44 Lincoln Ave., Mt. Ephraim, N. J.

ARMY OFFICER wants Echophone EC-1 or Hallicrafters Sky Buddy for cash. Must be good. Lt. Ernest R. Blanchard, Statistical Officer, Army Air Field, Avon Park, Fla.

FOR SALE—McMurdo Silver radio about 7 yrs. old in running condition. Incl. chassis, speaker, power supply. Carl L. Horton, % Geo. H. Webster Sole Co., Athol, Mass.

FOR SALE—Majestic phono motor, 110v, 60 cy., with 12" turn table, $5; also, Corona Special portable typewriter in carrying case with manual, good condition, $35. F. V. Hartmann, 32-26—54th St., Woodside, L. I., N. Y.

WANTED—Radio 4-5 wave band tuner with crystal control and speaker, Hallicrafters preferred. Also want sig. generator. Cash. H. A. Ziola, 555 Sloane Ave., Mansfield, Ohio.

WANTED—Hallicrafters Sky Buddy receiver or what have you along these lines? B. F. Roberts, 1609 University Ave., University, Va.

URGENTLY NEEDED—Type 50L6 tube and 150v a-c or d-c meter. H. L. Brown, 747 Manor Ave. S.W., Canton 4, Ohio.

WANTED—Late model set analyzer & tube tester or sig. generator & tube tester; also phono-recorder (portable) with mike or a good amplifier with mike. P. W. Hoover, 907 Lippert Rd. N.E., Canton 4, Ohio.

URGENTLY NEEDED—Several each of the following tubes in sealed cartons: 12SA7, 12SK7, 12SQ7, 12SG7, 1A7G, 1H5G, 1N5G, 35Z5GT, 25Z5, 50L6GT, 35L6GT, 25Z6GT, 117Z6GT. OPA list prices. O'Brien, 609 W. First St., Fulton, N. Y.

FOR SALE OR TRADE—Five large voltmeters, ammeters, wattmeters, portable case laboratory type. All for $50 or exchange for pro automatic record changer, or large receiver chassis. Garry Ellerman, Box 218, Yankton, S. Dakota.

WANTED — New or used RCA Rider Chanalyst or Meissner Analyst and tube tester. Robert Vannini, 80 Norman St., Springfield, Mass.

NOTICE!—Please write plainly and describe your equipment accurately when sending advertisements to be run free of charge in the Sprague Trading Post. This will help simplify our job of handling a tremendous number of advertisements every month — and will assure prompt, accurate presentation of what you have to sell or what you want to buy.

WANTED—12, 25, and 50 volt tubes, or what have you, in sealed cartons. Louis La Flem, 421 E. 22nd St., New York, N. Y.

WANTED—Two each 35Z5; 6Q7; 50L6; and 1A7 tubes. Also want set of radio tools. J. H. McAleer, 1004 Sigsbee Place N.E., Washington 17, D. C.

WANTED—Used tube tester. Have .22 cal. slide action 15-shot rifle to trade. Timmy Vickers, 39 Prospect Ave., Sausalito, Calif.

WANTED—Late edition Ghirardi's Radio Physics Course book. Geo. E. Aldrich, 150 W. 98th St., Apt. 31-W, New York 25, N. Y.

WANTED—One 12SA7 tube. Cpl. Greg. Swiska, 66th Signal Repair Co., Holabird, Baltimore, Md.

FOR SALE—One of each: 15; 24A; 26; 71A tubes. Two of each: 2A5; 57 and ten 01A good used tubes. 50% off or all for $6. Also two 6" PM speakers; 1- and 2-gang var. condensers, radio cabinets and parts for Majestic 90 & 93 and Zenith Auto 6M193. Urgently need a 6v gasoline driven battery charger about 250 watts preferred. Must be OKay. Velmer Z. Zeigler, R.R. #1, Huron, So. Dak.

WANTED — Multimeter & signal generator, preferably Supreme, Jackson, or Hickok. V. B. Wiedeman, 531 N.E., 8th St., Oklahoma City 4, Okla.

WANTED FOR CASH—Skybuddy S-20R, EC-1 or what have you? T/Sgt. Wm. P. Norman, 17032307, Section P, Bks. 141, Scott Field, Ill.

FOR SALE — One #077 Philco signal generator like new, $35.50 postpaid. Luther M. Allen, McCrory, Ark.

WANTED — Tube tester and sig. generator. Paul Shindel, R.F.D. #2, Allegheny ville, Penna.

WANTED—Cash for good tube checker and signal generator. Have OC Clough-Brengle sig. generator and Weston 677 tube tester for sale; also have new 35Z5 and 50L6 tubes. Henry Perka, 18 Warner St., Groton, Conn.

FOR SALE—One RCP tube checker #308 portable type, like new. Hershel Parker, Liberty Theatre, Shamrock, Texas.

—SEND US YOUR OWN AD TODAY!—

For over two years now, the Sprague Trading Post has been helping radio men get the materials they need or dispose of radio materials they do not need. Literally thousands of transactions have been made through this service. Hundreds of servicemen have expressed their sincere appreciation of the help thus rendered.

Send your own ad to us today. Write PLAINLY—hold it to 40 words or less—confine it to radio materials. If acceptable, we'll gladly run it FREE OF CHARGE in the first available issue of one of the five radio magazines wherein the Trading Post appears every month.

HARRY KALKER, Sales Manager

Dept. RN-35, SPRAGUE PRODUCTS CO., *North Adams, Mass.*

Jobbing Sales Organization for Sprague Electric Company

SPRAGUE CONDENSERS
KOOLOHM RESISTORS

TM. REGISTERED U. S. PATENT OFFICE

Obviously, Sprague cannot assume any responsibility, or guarantee goods, services, etc., which might be exchanged through the above advertisements

Let's Talk Shop

(*Continued from page* 51)

the customer, since from time immemorial all radios were priced f.o.b. customer's home and that price included installation, regardless of its nature. Servicemen should be very careful in taking on television installations for any sort of a flat fee. The most logical thing to do is to spend the extra time looking over the location beforehand and then, furnish the price for installation. This wide variation in conditions, if not taken into account by the serviceman doing installations, probably will result in great financial loss to him. Servicemen are urged to begin to think now about their charges postwar-wise for this important work.

Perhaps at this point it will be well to warn existing service establishments of the type of competition that they will have after the war, which is not now in existence. By that I mean, the intrusion into the field of returning Servicemen from the Army and Navy, who have had fundamental training in ultra-high frequency fields. These men will have a head start unless the individual serviceman prepares himself by training now. In addition to this, the Government will supply for returning veterans the money necessary to engage in business. This also offers a very definite threat to existing servicemen in the way of competition. Couple this to the fact that the radio industry itself is intending to use these trained men from the Army and Navy for the installation and service work in the ultra-high-frequency fields, and you will see that the future of the individual radio serviceman is fraught with considerable danger.

However, it probably is a blessing in disguise since it will mean the servicemen who finally remain in business will be highly-trained, well-paid men. This cannot help but raise the standards of the service industry, which we all know are dangerously low.

-30-

U. S. EXHIBIT

HOW Uncle Sam has saved more than a billion dollars by the use of "ersatz" materials used in making combat communications equipment is shown in the Signal Corps Conservation exhibit now on nationwide tour of department stores.

The display illustrates graphically how a few of the 10,000 manufacturers producing more than 100,000 stock items for the Signal Corps have been able to effect vast savings in critical war materials — aluminum, copper, brass, chrome, mica, natural rubber, sole leather, and lumber, among hundreds of items—and in equally critical manpower. It shows in numerous display panels some of the methods by which approximately one billion dollars decrease in contract costs was accomplished in producing 1,551,000 tons of equipment. -30-

WHERE SKILL *SOLVES MANY A MAZE*

Intricate problems in electronic munitions making, requiring advanced radio engineering, find ready solution at International Detrola, where the quick questions are: how well? —how exacting?—how swiftly can we build it? Trainloads of first-quality equipment sent to our troops afield echo the answers. The day is coming when these war-tested talents will provide the very finest in Detrola-built Radio Receivers . . Television Receivers . . Automatic Record Changers, and other electronic instruments.

DETROLA RADIO

DIVISION OF INTERNATIONAL DETROLA CORPORATION • BEARD AT CHATFIELD, DETROIT 9, MICH.

C. RUSSELL FELDMANN PRESIDENT

BUY MORE WAR BONDS

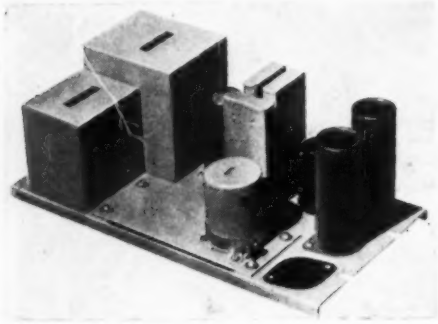
WHAT'S NEW IN RADIO

New products for military and civilian use.

TWO NEW AMPLIFIERS

The Langevin Company, Inc. has recently announced the addition of two new amplifiers to their line of sound equipment.

The 101-A is designed primarily to



transmit low-frequency waveform at high output levels and is intended to be used to feed groups of wide-range loudspeakers where excellent music reproduction is required.

The internal input impedance is 1,500 ohms, high gain and 25,000 ohms bridging. The output impedance is adjustable to match loads from 1 to 1,000 ohms. The amplifier delivers 50 watts to a nominal load impedance with less than 3% r.m.s. harmonic distortion at 400 cycles. The unit weighs approximately 45 pounds and is finished in light gray baked enamel over zinc plating.

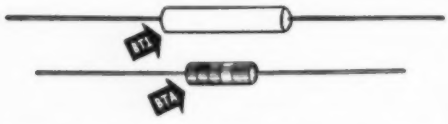
The second unit, known as the 102, meets frequency-modulation requirements as to frequency response, power output vs. distortion, and noise level. Four different types of amplifiers are included in the 102 series and are designated as the 102-A, 102-B, 102-C,, and 102-D.

The Langevin Company, Inc., 37 West 65th Street, New York, will furnish full details on any or all of these units upon request.

NEW IRC RESISTORS

A new addition to *International Resistance Company's* BT line of resistors, the BTA insulated 1-watt resistors, has been announced recently.

Designed primarily for applications



requiring AWS RC30 Specifications, the BTA may be used in a wide variety of limited-space, lower-power applications.

The type BTA is .718" long by .250" in diameter. It has a wattage rating of 1-watt at 40 degrees C ambient and a voltage rating of 500 volts. The minimum range is 330 ohms, while the maximum standard range is 20 megohms. Higher ranges are available on special order.

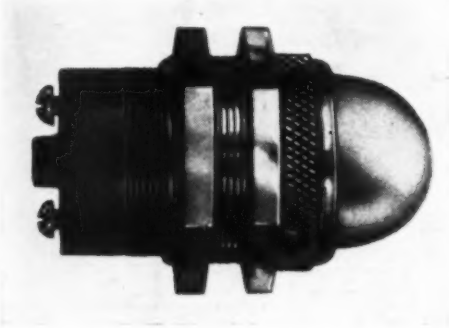
Delivery is available at once on priority orders and further technical data will be supplied upon request to Dept. N20, *International Resistance Company*, 401 N. Broad Street, Philadelphia 8, Pa.

PANEL LIGHT

A new indicating light for 120-volt service has been introduced by the *H. R. Kirkland Company* as their De-Luxe No 659 D-E unit.

This unit has an over-all depth behind the front of the panel to the extreme end of the insulation barrier of only 1". It is designed for single-hole mounting in a 1⅜" diameter hole in panels up to ¼" in thickness.

The exposed holding lip is of the hex-nut type. The screw-type lens cap, which contains the heavy walled glass lens, is removable from the front of the panel which permits easy installation and removal of the lamp bulb. The lamp bulb protrudes well into the cup of the lens, thus providing good visibility from all forward angles.



The molded bakelite socket is of the candelabra screw-base type for use with the S6-120-volt tungsten lamp or the T4-½ Neon glow lamp. A ¼" square insulation barrier separates the two 6/32 terminal screws. The terminal screws go directly to the two sides of the lamp contacting members providing a direct-line electrical contact without the use of solder.

Complete details regarding this lamp will be furnished upon request to *H. R. Kirkland Company*, Morristown, New Jersey.

NARROW LEVER KEY

Federal Telephone and Radio Corporation has announced the production of a new lever key which is only 7/16" wide and is used for control purposes in electronic and communications equipment where small size is an important consideration.

According to the company, although this key is narrower than any other existing key, the reduction in size has been accomplished without any sacri-

fice in versatility as the 18-spring capacity permits more than 500 possible switching combinations.

This unit is designed for one or two-way, locking or nonlocking operation. The entire key assembly is held together by a single screw to facilitate disassembly. The spring pile-up mounts on one side of the two-piece pressed steel frame, with all front-position springs in one group and all back-position springs in another.

The contact springs are of nickel silver with palladium cross-bar contacts and brass backstop springs are provided for tension adjustment. Non-click buffer springs are supplied for use in circuits where spring backlash is to be avoided. All springs are interchangeable and the pile-ups may be easily rearranged.

The FTR-810 series key can be furnished in fungus and moisture-proofed form to meet Signal Corps specifications.

Further data on the lever key will be furnished upon request to *Federal Telephone and Radio Corporation*, 32 Central Avenue, Newark 1, New Jersey.

SNAP-ACTION RELAY

Struthers-Dunn, Inc. has announced that their snap-action relay, the Type 79XAX, has been redesigned to permit its use in a wider variety of applications where lower cost and ease of adjustment are important factors.

All parts of this relay are readily accessible and sensitivity adjustments may be made easily and quickly. The snap-action design assures full normally closed and open contact pressures. The armature of the 79XAX almost completes its travel in either direction before the contacts snap into the new position. This feature permits an unusually broad range of use, including vacuum-tube circuits, overcurrent protection, pulsing circuits, and applications where extremely close differential or extreme sensitivity of operation is required.

Contact ratings up to 10 amperes,

RESISTORS

The wire-wound resistor you need is made by Ward Leonard

Ward Leonard resistors include a full range of types, sizes, ratings, terminals, mountings and enclosures. They are built to withstand heat, moisture, vibration and other adverse conditions.

The electrical and electronic industries depend on Ward Leonard—pioneers in the commercial production of vitreous wire-wound resistors—for resistance units to meet each new development. Ward Leonard engineers are always glad to assist in working out special applications.

Rear view of a modulator unit showing Ward Leonard Resistors in Station WABC, Columbia Island, New York

RHEOSTATS AND RELAYS — Ward Leonard is headquarters for electrical controls of all kinds. A comprehensive line of rheostats and relays has been developed hand in hand with the development of vitreous wire-wound resistors.

WARD LEONARD ELECTRIC CO.
47 SOUTH STREET, MOUNT VERNON, N. Y.

ARMY E NAVY

WL

WARD LEONARD

ELECTRIC CONTROL DEVICES SINCE 1892

115 volts, a.c. may be obtained with 100 or more ampere turns and a corresponding increase in power. A sensitivity of .005 watts with 30 ampere turns is obtainable with reduced contact pressures and ratings.

A newly revised bulletin covering the new construction and its applications is available upon request to *Struthers-Dunn, Inc.*, 1321 Arch Street, Philadelphia 7, Pa.

NEW PLASTIC CLIP

In order to facilitate the fastening of wires to aircraft interiors and miscellaneous other supporting structures, the *Commercial Plastics Company* of Chicago has developed a plastic clip known as the CPC 1051.

This clip is made from a special formulated ethyl cellulose plastic and can be used in radio, aircraft, and other multiple wiring applications. An exclusive "rolled edge" feature prevents wear on the wire insulation regardless of vibration. The resiliency of the material itself contributes to protection against short-circuiting.

A saving of manpower may be realized upon the adoption of these clips inasmuch as no insulation is required. The clips display great fatigue and impact strength as well as a wide range of temperature resistance and dimensional stability.

Further details of applications will be furnished to interested readers upon request to *Commercial Plastics Company*, 201 North Wells Street, Chicago, Illinois.

MICROPHONES

Early in 1945 the *Universal Microphone Co.* of Inglewood, Calif., reissued its CU-1 and CU-2 microphones for mobile transmitter installation, including marine and aircraft installation. The precision instruments also are adaptable to many forms of transmission use in broadcast stations, amateur, and other outlets.

The button impedance is 200 ohms and the output approximately 30 volts r.m.s. across the microphone transformer secondary. A d.p.s.t., press-to-talk switch connects the microphone and relay circuits.

This standard microphone is rugged and durable and withstands abrupt climatic changes.

Motor noises, on mobile installations, are damped out by antinoise design. Both models are single buttons with plastic case and special moistureproof cord reinforced at each end.

The CU-1 has a three-way plug, while the CU-2 has the PL-68 telephone type of plug. *Universal* also will resume production soon with its KD and 15 mm's., both dynamics; the 200 series, handitype; the 800 series, velocity; and the X-1 and XX, both carbons, as postwar microphone releases.

NEW TUBE EXTRACTOR

From the *BMP Company*, comes an original device for the extraction of standard-size metal tubes, which has within recent weeks been placed on the market.

Eliminating the former hazards of tube extraction, the new BMP Metal Tube Extractor does away with burnt fingers, jiggling around to get the tube out, and snapping caps. Constructed

of one-piece steel, plain, zinc, or cadmium plated, this very simple device contains no screws, rivets, or welds. With the new *BMP* Tube Extractor, just one firm pull is all that is needed in order to extract the hot tube. Designed and built to last a lifetime, it fits all standard size metal tubes.

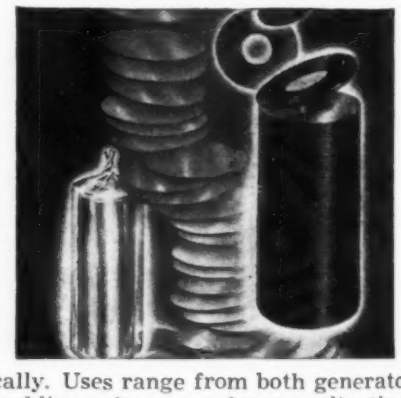
These Tube Extractors may be used successfully in laboratories, shops, and in testing and inspection lines. They are available in any quantity.

For further information, write the *BMP Company*, Boonton, New Jersey.

CARBON PILE RHEOSTATS

Under impetus of war requirements demanding more dependable resistance variation, the *Stackpole Carbon Company*, St. Marys, Pa., has developed many new types and sizes of continuously-adjustable carbon rheostats formed of Carbon Disc Piles.

Simply by changing the pressure applied to these Piles, every possible resistance value within their range is made available without opening the electrical circuits in which they are connected. The pressure to vary the resistance to the most critical adjustment may be applied electrically, mechanically, centrifugally, or hydrauli-



cally. Uses range from both generator and line-voltage regulator applications to speed control through governed field current on motors, while many other projects are now in the development stage.

These Carbon Piles are available in practically any length pile and diameter required. Careful engineering

Hold it!

YOU belong in this picture Mr. Radio Merchant!

We're referring to the after-the-war picture following the first mad, public scramble for any kind of radio—when people again begin buying on actual merit and value. That's the picture YOU should fit into—and will fit into—if you handle the Temple line!

Temple Radios, too, will sell fast from the very first, BUT—Temple will build from that very first on a basis of sound permanency that insures lasting profits to its Dealers and Distributors.

Distributors and Dealers interested in participating in the Temple postwar picture are invited to communicate with us now—today!

Temple RADIO

TEMPLETONE RADIO MFG. CORP., New London, Conn.

FM . . . TELEVISION . . . RADIO-PHONO' COMBINATIONS

FM F M

Licensed under Armstrong and RCA patents

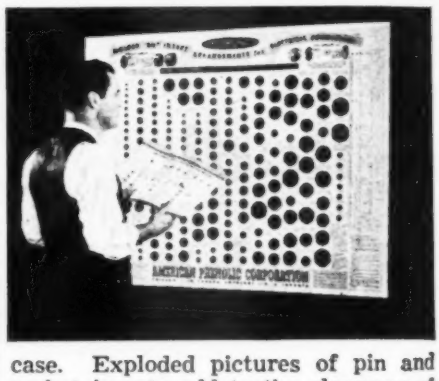
control assures a high degree of uniformity on a quantity production basis. Typically, a Carbon Disc Pile 1½" long composed of discs .432" in diameter permits a resistance range of from 60 ohms with 1-ounce pressure to .3 ohms at 32-pounds pressure.

A bulletin giving complete engineering data will be sent on request to the *Stackpole Carbon Company.*

INSERT CHART

A unique, complete, and practical Chart of Molded AN Insert Arrangements for Electrical Connectors has been published recently by *American Phenolic Corporation.* It is an easily readable addition to any engineering department or drafting room dealing with this type of equipment. Knowing the required number and sizes of wires, an engineer can make proper selection as the inserts are grouped plainly by total number of contacts in vertical columns—in numerical order—reading from top to bottom and left to right.

All standard inserts from 1 to 100 contacts are shown full size and all socket or pin arrangements are indicated clearly, together with wire sizes, including coaxial cable connections and grounded or shorted inserts. Mechanical spacing of contacts and alternative positioning of inserts with new position numbers are given in each



case. Exploded pictures of pin and socket inserts add to the clearness of the chart, which is 50" × 38" and printed in blue and black on heavy, durable yellow stock, aiding in making the information readable from desk chair position.

A complete chart of AN and Amphenol 97 shell types and styles is enclosed with each Insert Chart, including special-purpose shell types such as pressure-tight, moisture-seal, explosionproof, lightproof, and other plugs and receptacles.

Also enclosed is a chart which diagrams the system clarifying the long and complex numbers used in specifying connectors. This would make intelligible a number such as AN 3100-16-11-PY (101 S-8M). This chart also includes even the proper designation for connectors to be given the tropicalization treatment.

A copy will be sent promptly on receipt of a request on the company's letterhead, addressed to *American Phenolic Corporation,* 1830 S. 54th Avenue, Chicago 50, Illinois.

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MR. RADIOMAN: You Can Use These "Tools" To Build a Better Job and a Secure Career in RADIO-ELECTRONICS

CREI Home-Study Training in Practical Radio-Electronics Engineering Combined With Your Own Experience Assures You of Post-War Security and an Interesting, Profitable Career

What's ahead for *you* in the post-war field of Radio Electronics? One thing is certain. After Victory is won, Radio-Electronics will surge forth as one of America's foremost industries, offering promising careers for radiomen with modern technical training.

But, you won't be able to merely step into the job of your choice. After the war, it will be "the survival of the fittest." Employers will once again be "choosey." Only the best qualified men will be selected for the best jobs.

NOW is the time to take the time to prepare yourself for these important, career jobs in radio-electronics engineering. CREI can show you the way by providing you with the "tools" to build a firm foundation of ability based on a planned program of technical training.

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Installation and Maintenance of

NAVY ELECTRONIC EQUIPMENT

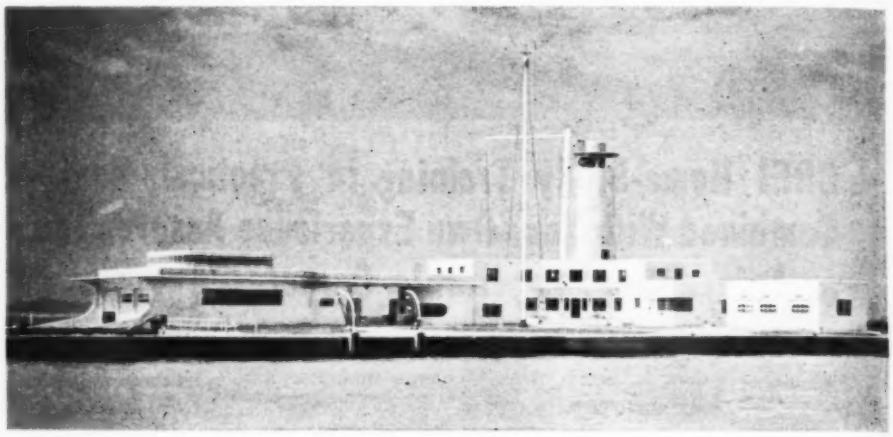
Headed by Comdr. H. E. Bernstein, USN, our Navy's Installation and Maintenance Branch, employing thousands of men, must keep all its radio equipment in fighting condition.

THE problem of installing and maintaining the tremendous amount of radio, radar, and sonar equipment in the Navy's ships, its many shore stations, and on special Marine Corps amphibious vehicles and bases, emphasizes how a difficult and complex task can be accomplished by teamwork and coordinated effort on the part of thousands of workers.

The story starts in the Electronics Division of the Bureau of Ships at Washington where the Installation and Maintenance Branch, headed by Comdr. H. E. Bernstein USN, does all the planning and staff work necessary to a complete and accurate installation job.

As an example of the planning required, consider the case of a new class of destroyers on which it is planned to install radio, radar, and sonar gear. First, the problem of weight is involved. Antennas, cabling, power supply, and apparatus for the complex installation on a modern destroyer add a great deal of weight to the ship, some of it well above the keel. Stability of the ship must be safeguarded by careful study of the proposed weights and locations, each piece of equipment being carefully checked for weight and space requirements, and then reviewed from the standpoint of coordination of all parts for efficiency in battle. Locations of antennas must be studied from a stability and interference standpoint. Location of delicate parts must be arranged with respect to the location of heavy guns; special shock mountings must be provided in some cases, and cabling must be laid out in such a way as to gain maximum protection against damage. In these studies, the Bureau of Ships' experts in various scientific fields are consulted to insure accuracy and soundness in the decisions made. Finally, when the installation plan is completed, it is sent to the building shipyards and Navy Yards. The installations on the first ships of a new class are carefully observed in order that desirable changes in the installation plan may be promptly made so that all subsequent ships will benefit by experience gained on the prototypes.

At this point, the installing activity takes charge. Each Navy Yard and Naval District has under its jurisdiction a group of technically trained officers and civilian employees who make the actual installation. In addition to these men, the Electronics Division guides the activities of a large group of electronic engineers who are employees of various manufacturers. These engineers are dispatched to all Naval activities to act in an advisory capacity concerning problems of installation and maintenance, principally on the equipment made by their employers. They have been and are continuing to be of great assistance in some of the more difficult installations.



The Cleveland Coast Guard Lifeboat Station, equipped with low-power radiophone. Lifeboats operating from this station are equipped with two-way radio.

Major Sherwood F. Moran (left) and Major Robert N. Hall, Marine Corps officers, with some of the Japanese radio equipment captured during recent offensives.

Of necessity, the Navy must maintain a large number of shore radio stations in order that contact may be maintained with the various units of the Fleet and with the central communication centers of the Navy and our allies. In addition to the hundreds of radio stations located throughout the continental United States there have been established many stations in advanced areas. These stations facilitate our operations in the far reaches of the Pacific, and additional units must be established around the perimeter of operations as the fleet moves forward. These stations range from simple installations to large and complicated systems, exceeding in size some of the largest commercial installations. Because of the unprecedented expansion of the Navy's air arm, it has

been found necessary to establish hundreds of Navy air stations both for operation and training. The electronic installations at these air stations represent the latest and the finest in radio and radar systems. They must be in continuous operation and are spread to the four corners of the globe. This shore activity alone is larger than the combined operations of those of all the commercial air fleets now existing in the majority of the allied countries. It might be pointed out that on December 7, 1941, the Japanese Navy failed to destroy our high-power station at Pearl Harbor. This error on their part will contribute to their ultimate defeat, since its subsequent operation was the link connecting the Pacific areas with Navy headquarters in Washington.

The Installation and Maintenance Branch of the Electronics Division is charged with the proper planning for the installation of electronic equipment in all Marine Corps amphibious vehicles. The Marine Corps, in connection with the Navy, maintains and operates numerous advance base radio stations and control centers. It might also be pointed out that thousands of walkie-talkie sets and similar equipment are used by the Marine Corps. An interesting sidelight on the use of the Marine Corps equipment is that it is required to operate many times partially or completely submerged in water and under conditions which would make the average radio equipment fail in less than an hour's time. The Marine Corps, in cooperation with the Installation and Maintenance Branch of the Electronics Division, is charged with the installation and maintenance of all communication equipment used in the continental United States and points abroad for maintaining internal security, and with the installation and maintenance of all communication equipment used between shore patrols and military police jeeps in their respective headquarters.

In addition, the Electronics Division has recruited and trained a "flying Squadron" of carefully trained Navy technicians organized as the "Electronic Field Service Group." These technicians are assigned primarily to absorb the impact of new programs or projects which would place too great a load on the normal facilities of the Navy Yards and other installing agencies, and to handle other emergency work. A picked group of these technicians travel with the fleet wherever it goes, transferring from ship to ship as the exigencies of the current situation demand.

The function of the Electronics Division in the maintenance of fleet electronic equipment involves four major activities:

(1) The direction of normal day-to-day maintenance by technicians aboard ship. Analysis of thousands of trouble reports each month gives a clue to types of preventive maintenance which will insure dependable operation at all times. Maintenance Bulletins containing valuable information on preventive maintenance and troubleshooting are prepared by the Division's engineers and distributed to all naval activities frequently.

(2) Liaison with all schools engaged in training naval personnel in the installation and maintenance of electronic equipment used throughout the Navy. This liaison work includes advising training schools on the technical aspects of their curricula and supplying them with adequate amounts of the latest equipment.

(3) Assisting repair facilities such as Navy Yards as required in the emergency work of repairing or replacing battle damaged equipment.

(4) Many additional publications dealing with special installation and maintenance problems are prepared by the Electronics Division's engineers aimed at improving the performance of radio, radar, and sonar equipment to the end that the fleet and naval establishment will have available, at all times, dependable, up-to-the-minute electronic equipment to play its great part in defeating our enemies.

Thus the Electronics Division of the Bureau of Ships is performing its job of coordinating the efforts of approximately 75,000 workers who have already installed almost two billion dollars worth of electronic equipment, and who are performing efficiently in the maintenance of this vast amount of radio, radar, and sonar apparatus.

—30—

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Short-Wave

(*Continued from page* 57)

AYC-8, 9.61, Rio de Janeiro, Brazil, 6-8 p.m.

GVZ, 9.64, London, 2:15-4:45 p.m.

CBFX, 9.63, Montreal, Canada, 4-9:05 p.m.

LRX, 9.66, Buenos Aires, Argentina, 4-8:40 p.m.

PRL-7, 9.72 Rio de Janeiro, Brazil, 4-6:30 p.m.

Incidentally, Mr. Boehnke uses a Hallicrafters "Sky Rider Marine" S-22-R communications receiver.

* * *

EAST COAST REPORT

Gilbert L. Harris, North Adams, Mass., reports:

HVJ, 17.445, Vatican City, heard 11:20-11:57 a.m., signoff.

Radio Atlantik, 7.020, heard at 5:45 p.m. On 9.800 and 6.22, heard signing off at 3 a.m.

ZQI, 4.700, Kingston, Jamaica, heard signing off at 7:34 p.m.; had news in English at 7:31 p.m.

TAP, 9.465, Ankara, Turkey, heard two recent Sundays from 4:25 to 4:45 with Postbags Nos. 9 and 10; told one SWL that TAQ in 19-meter band (15.195 mcs.) was on the air.

Leningrad, 11.642, heard relaying Radio Center, Moscow, at 10:50 a.m. recently.

DJW, 9.650, Berlin, heard at 2 p.m. "Voice of Free Arabs," 10.005, heard 2:15-2:31 p.m.

"Hungarian Nations Radio," 9.835, heard 1:15-1:31 a.m.

"Radio Tevere" (German controlled station in Italy), 8.550, heard at 2:55 a.m.

HH2S, 5.955, Port-au-Prince, Haiti, heard 7-9:55 p.m.

Greenland on approximately 10.240, was heard recently at 3:58-4:20 p.m., calling New York.

YV6RV, 6.200, Ciudad, Bolivar, Venezuela, heard with music at 11:45 p.m.

HJCD, 6.160, Bogota, Colombia, heard with music at 11:50 p.m.

HJCX, 6.018, Bogota, Colombia, heard with music at 11:55 p.m.

PJC-1, 5.945, Willemstad, Curacao, heard signing off at 12:35 a.m.

Mr. Harris reports that DX has been very weak in his region the last few weeks.

From Perth Amboy, New Jersey, Frank James Barry reports hearing XGOY, 7.155, Chungking, China, at 10:30 a.m. with English talk on "movement of Chinese industry in event of large occupation of China by Japanese." This program was also carried on 9.646.

TIPG, 9.620, San Jose, Costa Rica, heard signing off at 12:15 a.m.

Santiago, Chile, on 11.855, heard at 9:30 p.m. with good signal; no English used.

John W. Bornholdt, Lancaster, Pa., reports a "loud" signal from the new Canadian transmitter, CHTA, 15.22 mcs., around 11 a.m. DZD, 10.540, Berlin, has POW messages at midnight, Mr. Bornholdt says.

From Boston, Mass., William Cotter reports hearing OQ2AB, 15.320, Leopoldville, Belgian Congo, with English talk at 8:30 a.m., same announcer as "Radio National Belge." OQ2AB is reported to be operating with only 50 watts and is called "Radio Congolia"; a good catch!

A station announcing as "Radio Beam, Madrid, Spain," was heard recently on 29 meters calling New York at 5:08 p.m.

Mr. Cotter advices that "Radio France," reported heard 12-12:30 p.m., or later, is THA, Algiers.

* * *

WEST COAST REPORT

CALIFORNIA—From Los Angeles, August Balbi, reports this month that reception on the higher frequencies should be better in 1945. "There are signs of this already," he writes, "such as JLT3, 15.225, which is fair to good often, also VLC4 (15.315) and JBC (18.13) which have continued to come in during midwinter."

His monthly report on EWT follows:

DZD, 10.54, Berlin, 5:50-9 p.m., fades out then; DXC2, 11.74, Berlin, 10 a.m.-12 noon to Far East.

Radio Atlantik, 6.225, 9 p.m.-2 a.m.; weak signal.

Radio Congo Belge, 9.39, Leopoldville, Belgian Congo, 1-3 a.m. in French and Dutch only; French news, 2 a.m.

XGOY, Chungking, moved to 6.135 January 2; heard 7:35-11:40 a.m.; news at 10 a.m.

XGOA, 5.98, Chungking, was on this frequency two days in December; now is on 9.725.

Radio Shonan (Singapore), 15.45, Malaya, 6-7:30 p.m., 5-8:40 p.m. to U.S.; news at 7, 8 p.m.; some code QRM; fair signal.

JVU3, 11.897, JZJ, 11.80, Tokyo, 4:40-6:15 a.m.; news, 4:40 a.m.; Zero Hour, all-English program to South Pacific, 5-6:15 a.m.

RV, 9.565, Komsolmosk, U.S.S.R., 3-10 a.m.; to U.S., 7:40-8:30 a.m.; news at 7:40 a.m.

RW15, 5.935, RV, 8.815, RV, 9.565, all in parallel at times from 3 a.m. on in Home Service of the U.S.S.R.

CXA-19, 11.705, Montevideo, Uruguay, has French hour, 9-9:30 p.m.; announces as "Radio France."

VLC4, 15.315, Shepparton, Australia, is now being heard on the West Coast very well on the transmission to Eastern North America, 9:45-10:45 p.m., with news at beginning of the transmission and at 10:30 p.m.

A station that is new to this area is LRR, 11.88, Rosario, Argentina, heard 7-10 p.m.

JVW3, 11.725, Tokyo, is heard 9-10:40 a.m. and 11 a.m.-2:40 p.m., with news in English on the hour.

CSW-7, Lisbon, Portugal, on 9.74, is heard 9-10 p.m.

Another new one being heard on the West Coast is PRL-7, 9.72 Rio de Janeiro, Brazil, 7-10 p.m.

Delhi on 7.30 is heard, 7:30-10:30 a.m., with news in English at 9:30 a.m. The schedule of Delhi on 7.275 is 8-10 a.m., and 9-10 p.m., with news at 9:30 a.m. and 9:45 p.m.

VUD-2, 6.19, Delhi, heard 8:30-10 p.m., with a BBC relay of news at 9 p.m. On 6.15, Delhi is heard 10:15 a.m. to 12 noon, with news at 10:50 a.m., followed by a BBC relay of news at 11 a.m.

MTCY, Hsinking, Manchukuo, on 5.71, has news in English at 9:30 a.m.

Radio Saigon, 4.80, Saigon, French Indo-China, is heard 7:30-9:30 a.m.

* * *

MIDWEST REPORT

From Chicago, Larry Gutter, Hallicrafters monitor, reports:

"The over-all quality and number of overseas short-wave broadcasts to be heard here have dropped off considerably with the winter months. Generally speaking, daytime broadcasts have not been affected nearly so much as have nighttime transmissions. The 19-meter band is still quite active for Europeans during the mornings and early afternoons. For early morning reception, however, from 6 to 8 a.m., the 25-meter band must be used since 19 meters is almost completely dead then. London on 15.31 (GSP), seems to become strong toward the late morning, but is weak from 7:30 to 10 a.m. CWT. London transmitters broadcasting the African Service and General Overseas Programs on 15.26, 15.18, and 15.14, continue to be heard quite well from 9 a.m. CWT.

"The twenty-five meter band seems to be good all day until about 7:30 p.m., Chicago time, when the band begins to go dead. In a few hours, the 31-meter band begins to drop off. Even at the start of the North American Service from London at 4:15 p.m. CWT, the BBC's 31-meter transmitters on 9.825 and 9.64 do not seem to become immediately audible. To receive London I have found it advisable to tune to GSU at 7.26 to hear the beginning of the North American Service.

"Germany has become increasingly difficult to hear evenings. Right now the best bet is DXM-2 at 6.20, which is fairly strong, 6-9:30 p.m. CWT; there is a large amount of fone QRM, however.

"As for Asiatics, the only transmissions that can be relied upon for 'local reception' are the 7-7:45 a.m. CWT broadcast from VLC6, 9.615, Shepparton, Australia; Tokyo over JLT3, 15.225, around 6 p.m. CWT; and Moscow (transmitter in Siberia) at 15.23, 5:45-6:25 CWT. These are extremely strong.

"Moscow is heard weakly on 12.265, 8-9 a.m. CWT in Russian.

"Aden, Arabia's ZNR, 12.115, heard quite well, 10:45 a.m. to noon CWT; a call in English is given every 15 minutes."

Keith Hester, Chenoa, Illinois, sends along these tips (EWT):

JZU3, 11.897, and JLT3, 15.225, Tokyo, beamed to East Coast, 6:15-8:15 p.m. (7:15-9:15 a.m. next day, Tokyo time); identified by playing of oriental music and the whistling of birds.

FZI, 11.970, Brazzaville, French Equatorial Africa, beamed to Europe, Great Britain, the Near, Middle, and Far East, 2:45-3 p.m., 4:45-5 p.m.; beamed to Central, South, and North America, 7:25-7:45 p.m., daily; news in English heard at 2:45, 4:45, 7:25 p.m.

RNB or OPL, 9.783, Leopoldville, Belgian Congo, beamed to Europe, Central, South, and North America, and to the Near, Middle, and Far East, 8:15-9:15 p.m. and in the relay of the BBC's North American Service, 9:15 p.m.-10 p.m., and 10:15 p.m.-12:45 a.m., and BBC's Latin American Service, 10-10:15 p.m.; news in English, 8:15, 9:10, 10:45 p.m., and 12:30 a.m.

VLC6, 9.615, Shepparton, Victoria, Australia, 8-8:45 a.m. daily, in the first transmission to North America; identified by the call of the Kookaburra Bird; signoff is by playing "God Save the King" and "Star Spangled Banner"; sometimes when they sign off slightly later than usual, the latter anthem is not played; news at 8:01 and 8:35 a.m.

HCJB, 12.445, Quito, Ecuador, heard in English, 6-7:15 p.m., generally; relays the United Network news in English from San Francisco at 6 p.m.

to destroy 'em you have to see 'em

Microscopes are gunsights in Medicine's battle on bacteria.

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They see what human eyes have never seen before!

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RADIO CORPORATION of AMERICA

PIONEERS IN PROGRESS

RCA

Radio Center, Moscow, 15.23, beamed to North America, 6:47-7:25 p.m., daily. Announced recently they were transmitting via 11.88, 7.3, 11.95, 15.53, and at 7:15 p.m. on 6.98. Did not announce 15.23, although they are being heard there regularly. Moscow signs on and off with the injunction, "Death to the German Invader." Moscow is back on the air at 8 p.m. on 7.3, 9.48, and 11.95, according to announcement.

Berlin comes through in the 16 and 25 meter band quite clear at 9:30 a.m., beamed to Central, South, and North America. In the evenings the North American Service from Germany is good in the 49-meter band (DXG, 6.190).

* * *

REPORTS FROM READERS

RHODE ISLAND—From East Greenwich, Rhode Island, Gordon Greene reports:

PRL-8, 11.72, Rio de Janeiro, Brazil, heard with excellent signal, 10-10:45 p.m.; news generally at 10:30 p.m.

COK (The National Sports Department), 11.570, Havana, Cuba, has good signal during late afternoons, early evenings.

VLC6, 9.615, Shepparton, Australia, puts in a very good signal, 8-8:45 a.m.

TGWA, 15.170, "La Voz de Guatemala," Guatemala City, Guatemala, comes in with a good signal in early afternoon.

CHNX, Halifax, Nova Scotia, has a fair signal on 6.130.

DXP, Berlin, comes in fair on 6.030; around midnight this transmitter has reached an R-9-plus signal.

CJCX, 6.010, Sydney, Nova Scotia, has a fair signal, evenings.

PRL-7, 9.720, Rio de Janeiro, Brazil, heard with fair signal, 4:10-9 p.m.

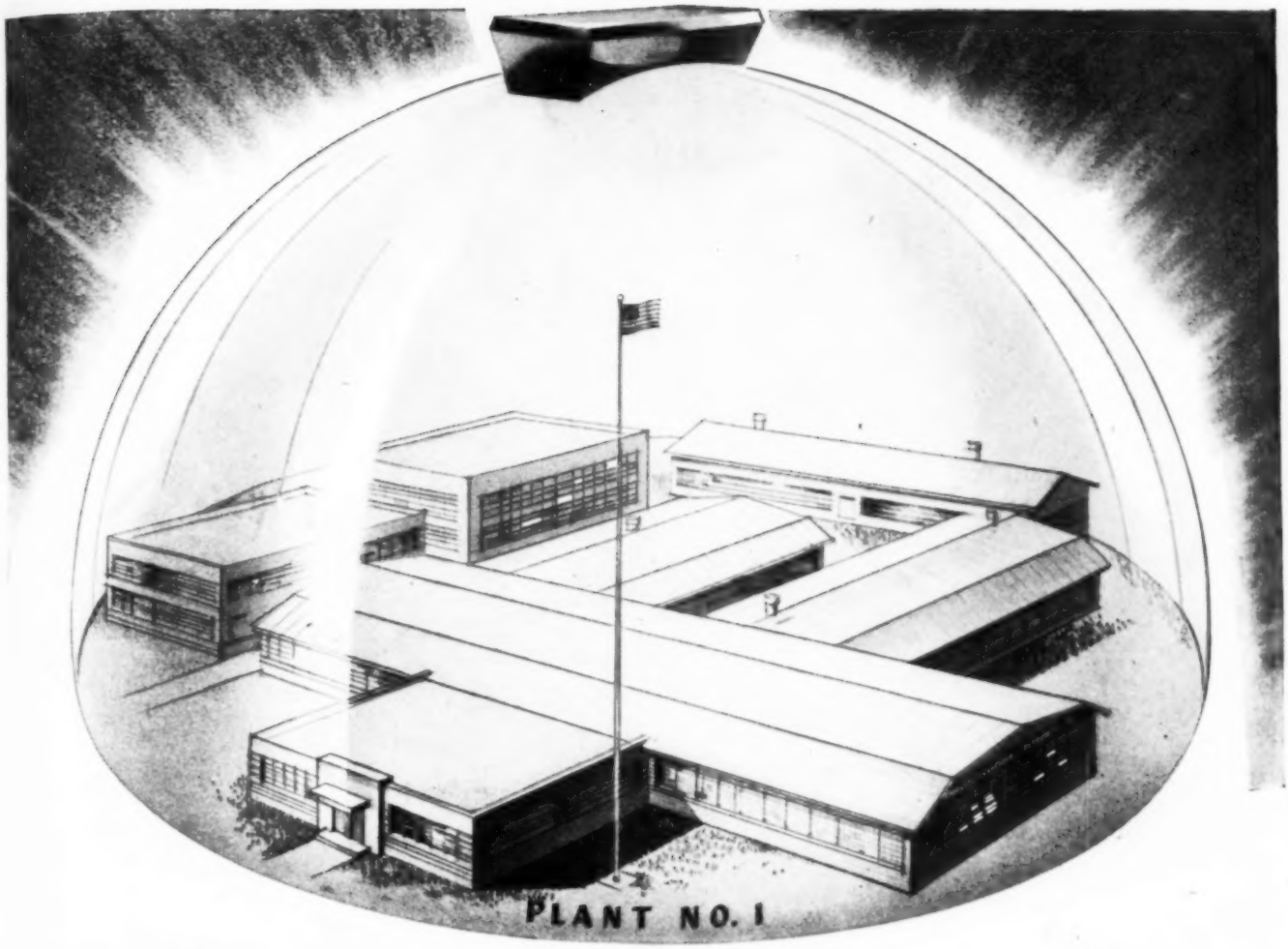
XERQ, 9.615, Mexico City, has a fair signal at 8 p.m.

(This is a good list for the three-tuber used by Mr. Greene—a 6J7 det., 6J5 1st audio, and 6V6 per amp., with 400 v. at 60 mils. running into it from an old power supply. "The set was built completely of junk parts, and I get excellent results with a 'V' antenna about 200 feet long," he writes.)

COLORADO—Otto L. Woolley, Colorado Springs, Colorado, lists VLC6, 9.615, Shepparton, Australia, 8-8:40 a.m., good; Tokyo on approximately 7.275, 12:15 a.m., on 9.535, mornings, on 11.897, 1-10 a.m., with news, and on 15.2, evenings; Moscow, 15.11, heard irregularly; Nassau, Bahamas, on 6.090, with relay of BBC news at 9 a.m.; and ZFY, Georgetown, British Guiana, 6.00, at 7 a.m.

MASSACHUSETTS—Jules P. Sussman, Belmont, Mass., reports that Radio Atlantik, 6.22, broadcasts 24 hours per day, music and news in German, interspersed; broadcasts are for benefit of German armed forces.

ONTARIO, CANADA—Albert E. Bromley, Toronto, Ontario, writes that he heard VPD2, 6.135, Suva, Fiji Islands, on two successive Sundays in December at 2 a.m., with relay of BBC news.



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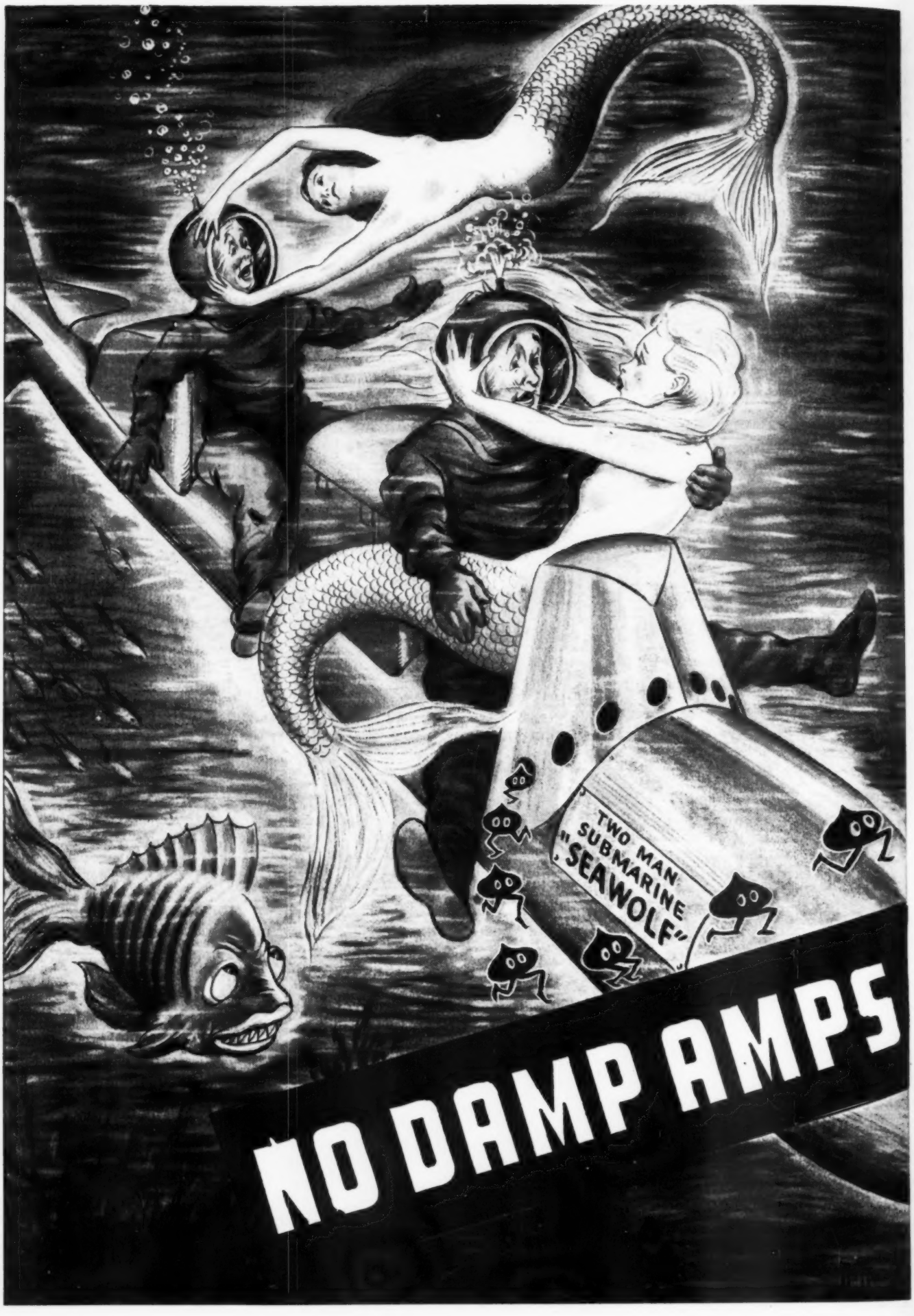
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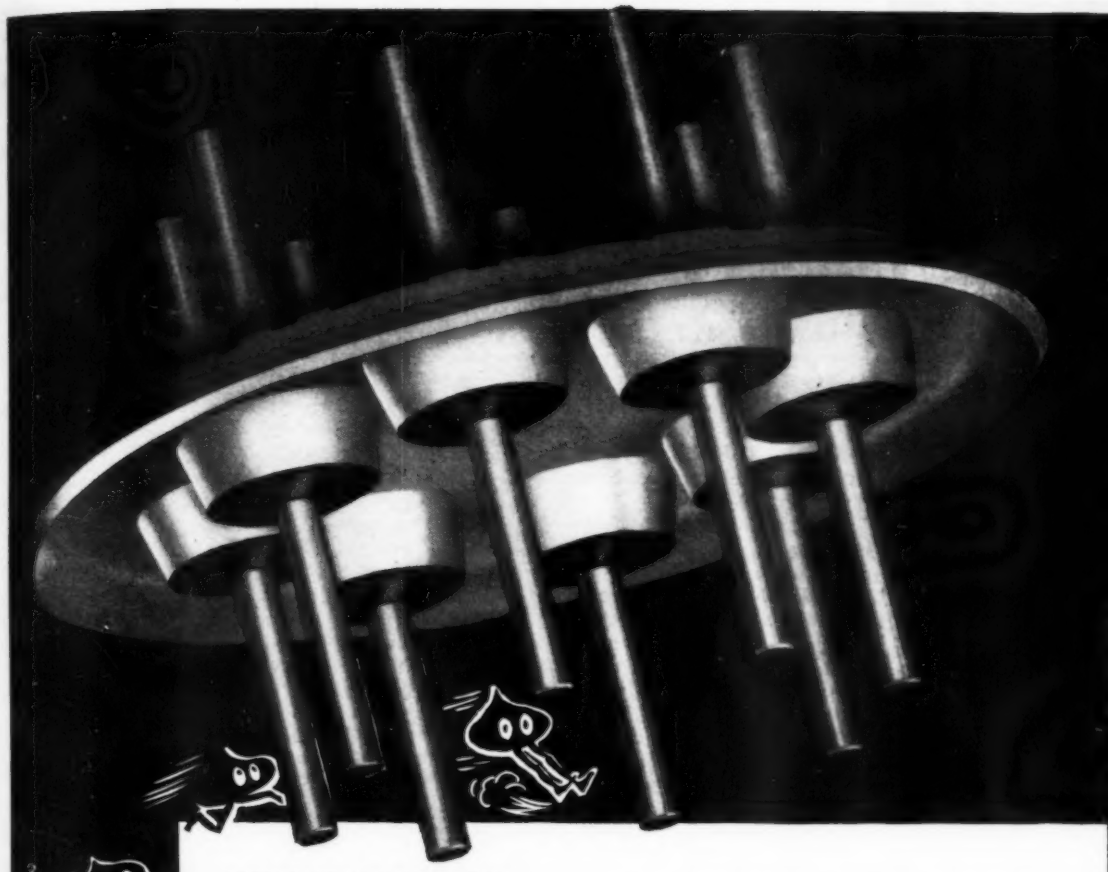
SUBMARINE
"SEAWOLF"
NO DAMP AMPS



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THE 'LECTRIC SCAMP,
FOR WHOM DAMPNESS HAS THAT FEELING;
BUT WHEN I'M DRY,
I'M REALLY HIGH,
AND I GO FOR *FUSITE SEALING!*

GLASS TO METAL

FUSITE

CINCINNATI ELECTRIC PRODUCTS COMPANY

NO DAMP AMPS!

CNR, 8.035, Rabat, Morocco, heard Sunday afternoons, in French.

Rio de Janeiro, Brazil, on 9.72, heard around 10 p.m. with news in Portuguese.

Mr. Bromley's best catch recently is ZLT7, 6.715, Wellington, New Zealand, picked up on Sunday, January 7, at 5:30 a.m., with the news in English, followed by sports news; signed off at 5:46 a.m.

NEW YORK—Bruce DeHond, Rochester, N. Y., reports a good signal from VLG3, 11.71, and VLG6, 9.615, Shepparton (Melbourne), Australia, 11-11:45 a.m.; news, 11 and 11:35 a.m.

He also reports hearing PJY calling at 11 a.m. on about 16.4 mc.

JVU3, 11.897, and JLT3, 15.225, Tokyo, to North America, 6:15-8:15 p.m.; good.

TAP, Ankara, Turkey, on 9.465, broadcasts 4:25-4:40 p.m. in English; good.

MAINE—Our first report received from "way down east" comes from John N. Dannert, Fort Fairfield, Maine, who reports hearing The British Station in the Mediterranean, in Jerusalem, Palestine, at 5:30 p.m. on 9.670 mcs. Radio Eire comes in well on 9.695, consistently, around 5 p.m.; signoff is at 5:30 to 5:35 p.m. Andorra is heard on 5.965 around 6 p.m. Australia on 9.615 and 9.590 very good mornings around 8 a.m. Berlin on 9.590 was heard recently in German at 3:30 p.m. (possibly a new frequency). British stations beamed on Europe come in fine in Maine.

* * *

ACKNOWLEDGMENTS

Many thanks for the reports that are coming in. Address all reports or inquiries to Kenneth R. Boord, c/o RADIO NEWS, 540 No. Michigan Ave., Chicago 11, Illinois.

* * *

LAST MINUTE TIPS

L. A. Ries, head of the general affairs department, the Netherlands Information Bureau, informs us that "there is no short-wave transmitter in the liberated part of Holland at this moment. The only medium-wave transmitter, working on 420 meters, is in Eindhoven. The name of this transmitter is 'Herrijzend Nederland' (The rising Netherlands)."

Paris on 9.62 mcs. is now heard 6-7 p.m., signs on with La Marseillaise, and is QRM'd after first fifteen minutes. (Sussman, Mass.).

Charles C. Boehnke, San Francisco, suggests that eastern DX'ers who have not yet heard Hawaii on short-wave, might try for KHE, 17.98 mcs., at 3:30 p.m. PWT (6:30 p.m. EWT) on Saturdays when they broadcast the network feature, "Hawaii Calls," for San Francisco. Also almost every day at 1 a.m. EWT, you can try for KEQ on 7.37 mcs., also in Hawaii.

A program in English announced as coming from "Radio Budapest," was heard recently at 9 p.m.; believed to be the "Hungarian Nations Radio" on 9.840 mcs. (Greene, Rhode Island).

On 6.090, ZNS is relaying broadcast-band station, ZNS, 640 kilocycles, from Nassau, Bahamas. This station was reported off the air for sometime but is now heard regularly, late afternoons and early evenings. Carl Horton, Athol, Mass., sends us the schedule of this short-wave station (he lists the call as ZNS2) as follows: 9-9:15 a.m., 2-2:30 p.m., 6-10 p.m. (Sundays to 11:15 p.m.); news at 9 a.m., 6:45 p.m., and 9 p.m. ZNS on 640 kilocycles comes in with a good signal around 7 p.m. in the East.

A station in Cairo, Egypt, on 7.500, announces in English at 11:45 a.m.

SUV, 10.055, Cairo, as "Voice of United Nations," is heard 1:50-3:30 p.m. signoff; English news at 2 and 3 p.m. Announcing as SUV and SUX is heard in English irregularly with news pickups, 6:15-6:35 p.m. Strong signals reported.

Radio Eireann, 17.840, Dublin, Irish Free State, heard 1:40-2:05 p.m. with news bulletin and talks.

The current schedule of VPD2, Suva, Fiji Islands, is Sundays through Thursdays, 4:10-5 p.m.; Sundays, 1:55-5:30 a.m.; Tuesdays with native program in Fiji tongue, 4-5 a.m.

Radio Saigon, Saigon, French Indo-China, has news in English at 10 and 10:45 a.m. on 11.775 (Harris, Mass.).

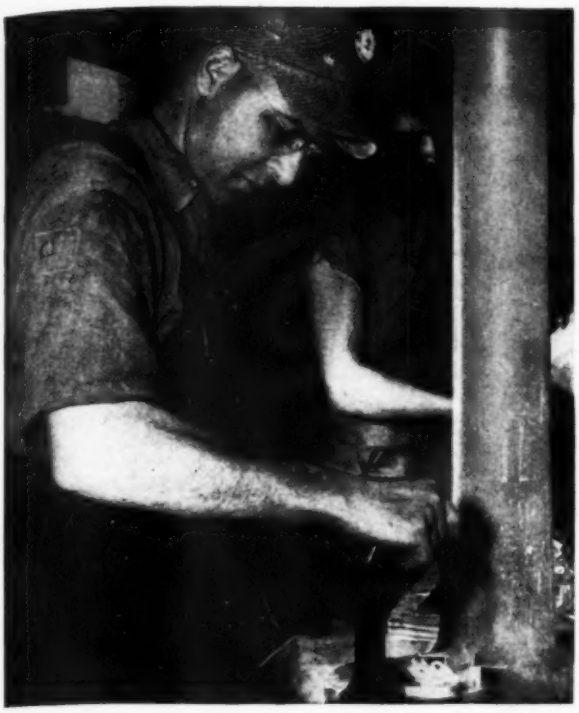
HBO, Geneva, Switzerland, 11.402 reported beamed to Australia, Tuesdays and Saturdays, 1-2:30 a.m. Has anyone in the U.S. heard this one recently?

Yng Ong, of Phoenix, Arizona, who monitors XGOY, The Chinese International Broadcasting Station in Chungking, for the Chinese government, informs us that XGOY has now moved to 6.135 mcs. for the North American transmission, 9:45-11:40 a.m. EWT. News in English is at 10 a.m., with a talk in English and press news in English from 10:30 to 11:40 a.m.

VUD-2, 6.19, announcing as "Armed Forces Radio, New Delhi," has been heard broadcasting from 9 to 10 p.m. to the armed forces. They relay a BBC newscast at 9 p.m. (Hanson, Washington).

From "Somewhere in the Arctic," Luther T. Cruse, Jr., chief radio officer, KHNT, writes: "In the October edition I noticed some of the readers want some press schedules. Rugby, England, transmits, at slow speed, on 16 kcs., 8,910 kcs., 18,650 kcs., 13,555 kcs., 15,690 kcs., using calls GBR, GID, GAD, GIH, GAY, or CYCT. The time of the broadcasts are 9030, 1300, 1600, 1935, and 2400 GMT. It is easier to get GBR on 16 kcs., when possible. If the DX'ers want some fun and good practice, they should try to copy some of the Russian stations when they are transmitting in Russian. It is good practice on accented letters; in fact, they are driving me completely nuts with their nonconventional letters."

After not having been logged for several weeks, HEO4, 10.342 (actually comes in on 10.338 at your short-wave editor's listening post), Bern, Switzerland, is again coming through with a



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strong signal in West Virginia, on its 3:45-4:15 p.m. transmission to North America.

CXA-10, Uruguay, relaying CX-14, heard evenings with R-9-plus signal on 11.90 (Hoiermann, Ohio).

L. Pavlov, of the Information Bulletin, Embassy of the U.S.S.R., Washington, gives us the following as the current schedule of English language broadcasts from Radio Center, Moscow:

7:40 a.m.—15.74, 11.83, 10.44, 9.5.
8:20 a.m.—15.74, 11.83.
12 noon—15.74.
2:30 p.m.—11.94.
6:47 pm.—11.94, 15.1, 15.2.
8 p.m.—11.94, 9.48.

—30—

Spot News

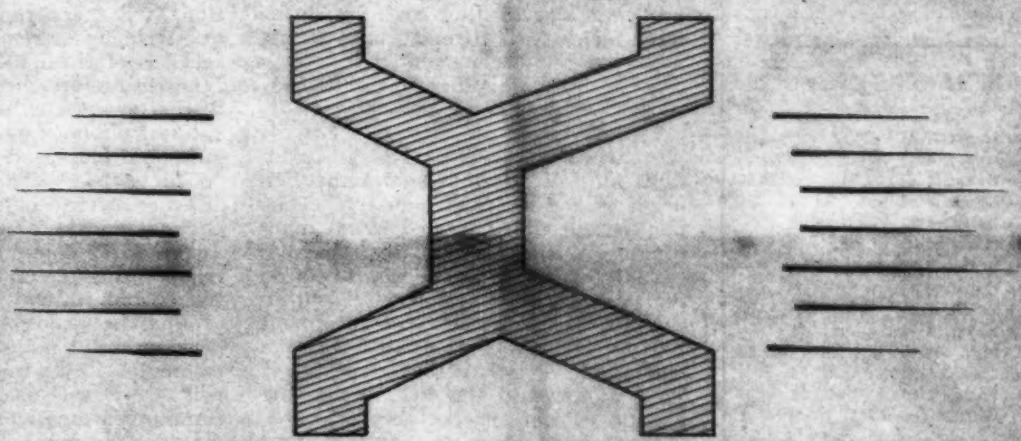
(*Continued from page* 18)

thus common carrier operation will not be permitted. In other words, the service will be a private one for Mr. and Mrs. Public. It will also be possible for taxicabs, delivery vehicles, and other mobile units to use this service, although the FCC did provide a special frequency for those types of service.

The FCC stated that they were fully aware of the interference problem that might arise. Discussing this phase in the report, they said . . . . "the success of the sharing arrangement in the amateur bands gives every reason to believe that it will be equally successful in the citizen's radiocommunication band. In the event that intolerable abuses arise, the Commission will take steps, of course, to eliminate them. The 10,000-kilocycle width of the band will no doubt be sufficient, however, to make possible simultaneous and efficient use of the limited-range service for many purposes with serious interference limited to few if any parts of the country. . . . In any areas where serious interference is experienced, it is the expectation of the Commission that various users of the band in a particular community will jointly seek, perhaps through local organizations similar to the ARRL, cooperatively to solve problems of interference."

Some interesting pointers on equipment design were also provided by the commission in the report. They said . . . "the design of equipment for use in this band should challenge the ingenuity of radio designers and engineers. A combination transmitter and receiver of reasonable weight can no doubt be mounted in a suitcase; a broadcast receiver, an alarm system, remote control systems, and other devices can perhaps be added to meet particular needs. . . . As in the case of amateur service the Commission proposes to assign no channels within the band. It is reasonable to suppose that most equipment will utilize a channel of 150 kilocycles or less making possible some 60 to 70 channels; but as in the amateur band, these

Quality Counts



IN THE International Bureau in Sevrés, France, there is a peculiarly shaped rod, a picture of which is shown above. That rod is the internationally accepted length of the meter, the basic unit of the metric system. Its length determined mathematically as a part of the terrestrial meridian contained between the north pole and the equator, its shape developed after much experimentation and its composition a special platinum and iridium alloy, it is a standard of quality to which the whole world refers . . . In the judging of any product, *it is the quality that counts.*

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matters will not be determined by rule or regulation. It should be possible by the use of comparatively simple circuits already known, to provide both transmitters and receivers tunable over all or most of the 460-470 megacycle range and emitting signals sharp enough to minimize interference."

According to the Commission it also should be possible to use booster or automatic relay installations where necessary. The rules have been made flexible enough to permit this service provided, of course, that high power and extreme antenna heights are not used. While no definite power is cited in the report, the FCC indicated that only low-power equipment is intended for this new service.

RADIO COMMUNICATIONS WAS TERMED A VITAL NECESSITY FOR RAILROADS in the FCC allocation proposal. And accordingly, a substantial number of channels were allocated for this purpose.

Many reasons were cited by the FCC for establishing and allocating frequencies for railroad radio, which, incidentally, was termed a new service. The Commission said that they were convinced that the carrier-current system of operation is not, at present at least, a practicable solution for all of the communication needs of the railroad industry. They pointed out that carrier-current manufacturers had testified that the operation of this system depended on the presence of wayside wires within a relatively short distance of about 100 to 200 feet from the railroad tracks for satisfactory operation. That alone, said the FCC, made the use of carrier-current impracticable for railroads operating over rugged mountain territory, such as the Denver Rio Grande. In addition the FCC cited the costs of carrier-current and space-radio equipment. They pointed out that carrier-current systems were too expensive to warrant installation, particularly if they are used with space radio to perhaps provide an all-inclusive system.

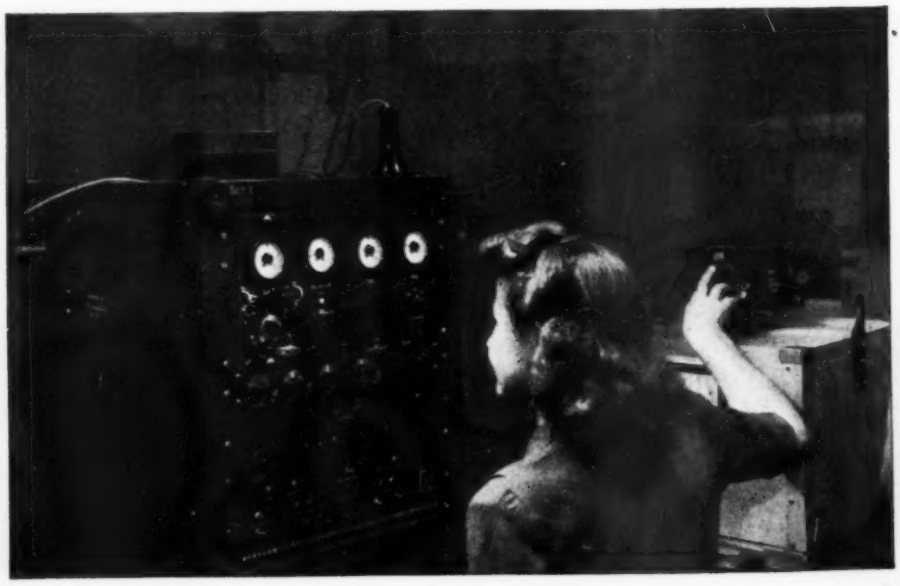
Carrier-current is not practicable for metropolitan terminals, viewed the FCC too. In Chicago where tracks go through city streets the cost of erecting the necessary wayside wires would be very great, said the FCC. And in addition, even if carrier-current were adopted for tunnel operations it would be very difficult to assign the necessary range of carrier frequencies for a crowded area like Chicago, where 33 railroads operate. Wayside wire lines also are subject to weather temperament and thus are not satisfactory. This was substantiated by testimony at the hearings.

The superintendent of communications of the Chicago, Rock Island and Pacific stated at a hearing that . . . "a part of the Rock Island territory lies in a heavy sleet and storm section . . . where the loss of our pole and wire lines frequently occurs over sections of from 100 to 150 miles."

Other factors that justified the new allocation were, according to FCC, safety, public benefit and convenience, and increased railroad efficiency.

Thirty-three channels in the 156-162-megacycle band with average channel widths of 60 kilocycles were assigned for communications between front and rear end of trains, between trains and railway employees on the ground, between passing trains, and between fixed points and trains. Between 156-159.12 megacycles, 26 channels were set aside for end-to-end communications service, which also provides for communications between trains and employees on ground and between passing trains. For railroad

Quartz crystals used in communications equipment for the Armed Forces are shown being examined in an automatic temperature-run test set at Kearney, N. J., Works of the Western Electric Co. This set, without human assistance, gives a laboratory examination of three critical qualities in each of 44 crystals, while it carries them from 60° below zero to near the boiling point of water.



PERFORMANCE

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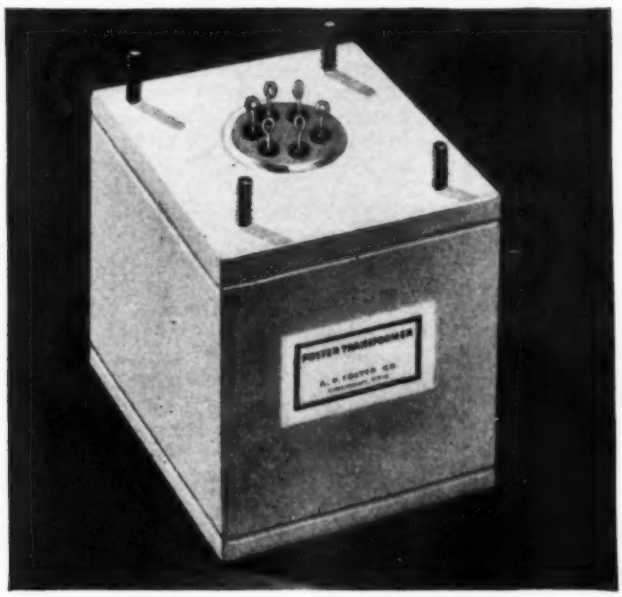

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yard communications, 44-50, 54-78 and 192-260 megacycles were set aside. These are to be used on an appropriate geographical sharing and noninterfering basis. In other words, if a television station happens to be assigned one of the lower frequencies, that frequency cannot be used by the railroads unless the area covered is too small to prompt interference. In most instances, a five-mile area is appropriated for the service. The same type of allocation system was worked out for tunnel operations.

Bands above 1,000 megacycles were also made available to railroads on an experimental basis. These bands included: 1900-2300, 3900-4550, 5750-7050, 10,500-13,000, 16,000-18,000, and 26,000-30,000 megacycles. Railroad officials indicated that in this frequency range radio-relay services will probably be established. In addition, remote control of centralized traffic will also be applied at these frequencies. Such a traffic-control system provides transmission of information concerning location of trains and controls movements of those trains from a centrally located point via the operation of signals and switches.

A NEW SERVICE WAS ALSO PROVIDED FOR buses, trucks, taxicabs, doctor's cars, ambulances, and other mobile traffic by the FCC. A dual form of program was provided by the FCC: one for highways and one for urban roads. In the highways division of the program, twelve channels were provided for in the 30-40-megacycle band for mobile units, while land stations received twelve channels in the 42-44-megacycle band. Seven channels were allocated to urban roads for mobile units and land stations in the 156-162-megacycle band. Incidentally in the highway proposal an average channel width of 40 kilocycles was assumed. The FCC pointed out that these channels will be integrated with marine service. The urban channels cover a width of 60 kilocycles and will be shared with forestry and conservation services and in addition integrated with marine service on a noninterfering basis.

Safety and efficiency were cited by the FCC as reasons for granting the new service. They said . . . "the proposed service should benefit a large number of people . . . and should contribute greatly to highway safety."

MARCH 15 WILL PROBABLY SEE the announcement of the final draft of the FCC allocation plan. This plan will be based upon hearings carried on during February with various members of the industry including the FMBI, RTPB, etc. At about this time, too, the proposals covering frequencies below 25 megacycles will appear in these columns.

THE CANADIANS NOW HAVE AN RTPB of their own. Several months ago we indicated that such a program was in the offing, and a short while ago the formation of the board was approved by the Hon. C. D. Howe, Minister of Transport. The Canadian unit is known as the CRTPB and has among its contributing sponsors the Canadian section of the ARRL, Canadian Association of Broadcasters, Canadian Broadcasting Corp., Canadian Electrical Manufacturing Association, Institute of Radio Engineers, Radio Manufacturers Association of Canada, the Railway Association of Canada, and the Telephone Association of Canada. R. M. Brophy who is president of the Canadian RMA, is also president of this new unit.

There are six panels in the present setup. These panels are devoted to: spectrum utilization and frequency allocation; standard broadcast (AM) and international short-wave broadcasting; radio communications, including point-to-point portable, mobile and emergency service communi-

(*Continued on page* 128)

Oscillator

(*Continued from page* 50)

V3 is interesting, as not a great deal appears in the literature of the art on this type of device. It is basically a two-stage direct-coupled amplifier consisting of the two triode sections of V3, a high-mu 6SL7GT tube. When in use, the oscillator feeds directly into the left grid, run at zero bias, and so prone to draw grid-current and upset the load upon the oscillator. To obviate the seemingly resultant shift in frequency when changing from sine- to square-wave output, series resistor R_{11} is placed in series with the grid of the first clipper to limit oscillator loading to a degree so small as to be undetectable. Plate voltage for this triode is developed across R_{16}, to which the second clipper grid is directly connected through first clipper plate load resistor, R_{13}. Square-wave output is taken from the second clipper plate circuit across R_{19}.

It will be noted that the resistor values of the two clipper circuits are quite low in terms of usual amplifier practice. This is necessary both to yield the desired clipping down of the sine waves into square-wave form, and to minimize the effects of unavoidable stray capacitances which would affect high harmonics, and so impair the square-wave shape. With this dual clipper, of desirably stable characteristics, square-wave output is almost perfectly square up to 6,000 cycles, with the leading edge rounding slightly and progressively between 6,000 and 20,000 cycles due to inability to eliminate all traces of capacitive strays from the several circuits involved.

It must be remembered that a

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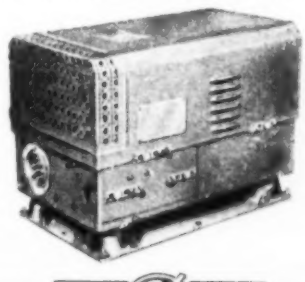
Write for further information of this and other models.



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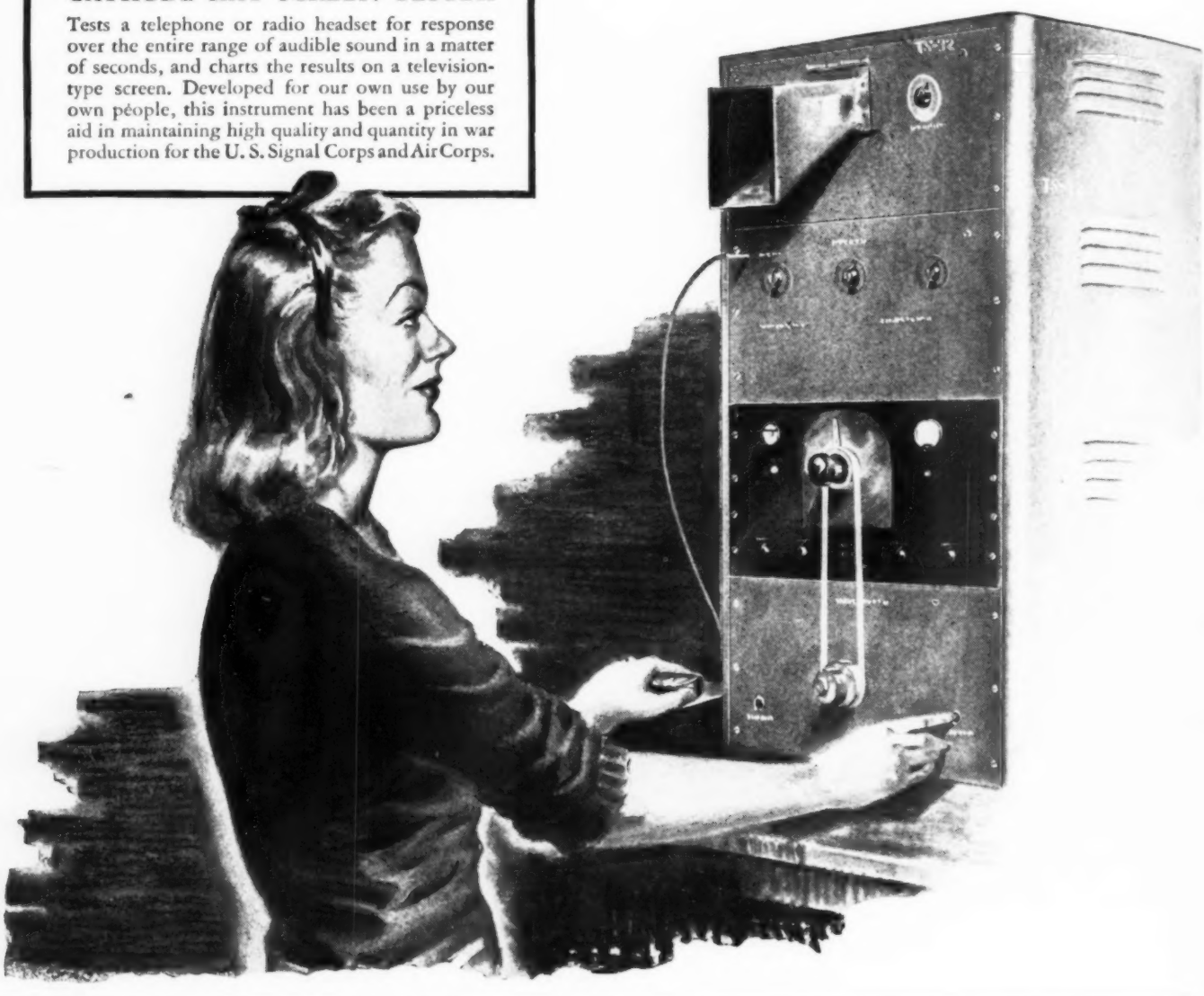

ARMY (E) NAVY

GAI

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square wave may be considered as being comprised of all the odd harmonics up to about the 100th of the fundamental frequency. Thus, a 6,000-cycle fundamental frequency, or repetition rate, means that frequencies up to 600,000 cycles are present in the output, else the wave would not be square. The whole desirability of square-wave testing lies in this fact, and application of a single low-frequency square wave to an amplifier, with output viewed upon a good cathode-ray oscilloscope screen, is actually the equivalent in frequency response indication to scores of individual sine-wave measurements the results of which must be plotted into curve form before they are quickly analyzable. A single square-wave test tells the whole frequency response story, plus the difficult to determine, but equally important ones of phase distortion and transient oscillation. For testing of wide-band television receiver video amplifiers such a square-wave generator is practically an essential "must." With proper allowance made for internal generator high frequency attenuation, this instrument may be successfully used for testing video amplifiers operating up to 2,500,000 cycles as well as all audio amplifiers.

In Fig. 2 the power supply components are seen at the left, with plug-in, instantly replaceable, military-type, electrolytic capacitors in the modern manner. The shield at the center houses the gang-tuning capacitor, and shields it from the power supply, as well as from the sensitive, high-gain amplifier which the whole instrument basically consists of. Hum in the output is a most serious problem in the design of such an instrument, and both shielding and isolation must be most carefully worked out to keep it at the substantially — 60-db. level of this example. An entire treatise might be written upon this subject alone, so difficult is the low-hum requirement of satisfaction. To the right are the oscillator, clipper and amplifier tubes, their coupling capacitors, the two automatic output regulator lamps, and the ceramic switch carrying the precision-matched metalized frequency-determining resistors.

Fig. 3 presents an interesting contrast—the combination of modern cabled wiring together with old-fashioned straight busbar connections. This combination is one of the secrets of the excellent performance obtained from the unit under discussion. It will be noted that all capacitors are either metal cased, hermetically sealed, oil impregnated units or plug-in electrolytic capacitors. Resistors are mounted either directly between lugs when connecting leads may be short enough to insure against failure under extremes of vibration (and when the criticality of the component function so requires), or upon high-grade insulating boards. Neatness and accessibility are the result.

—30—

HOWARD D. THOMAS, JR. general manager of Packard-Bell Company of Los Angeles, is the newly-elected president of the West Coast Electronic Manufacturer's Assoc., succeeding H. L. Hoffman of Hoffman Radio to the post. Mr. Hoffman was elected to the Board of Directors of the organization. Lew Howard, Peerless Electrical Products, will serve as vice-president and James L. Fouch of Universal Microphone is the new treasurer.

* * *

INTERNATIONAL RESISTANCE COMPANY has just completed a three-day conference of their sales representatives and company executives in Philadelphia.

Ernest Searing, president of the company, disclosed that the personnel expansion of the company has been nearly 800% since the war started and that plant and facilities expansion is upwards of 500%.

The representatives made a tour of the company's new Logan Plant and luncheon was served in the company cafeteria.

Among the guest speakers who addressed the group were Mr. Wallace Blood of McGraw-Hill Publishing Company, who spoke on "Electronic Markets"; Mr. George Barbey, past president of the National Electronic Distributors Association; and Mr. O. Fred Rost, publisher of the Wholesaler's Salesman.

* * *

FRED E. WALTERS has been appointed plant manager of the John Meck Industries of Plymouth, Indiana, according to the announcement made recently by John Meck. Mr. Walters joins the Meck staff from International Detrola Corporation where he was production manager for 2½ years. Prior to that connection, he was employed by RCA and General Electric Company in various capacities. Mr. Walters in his new appointment will be in complete charge of all production in the Meck plant at Plymouth, Indiana.

* * *

AEROVOX CORPORATION has recently changed ownership, the new organization being headed by W. Myron Owen, former vice-president of Detroit Harvester Company.

The company emphasized in its announcement that although the ownership has changed there will be no changes in personnel or policies of the company. Mr. Owen and a few private associates now own the stock of the company and no other company in the capacitor or electrical field was involved in the change.

Mr. Owen retains his position as director of the Detroit Harvester Co., as well as that of director of the Duncan Electrical Mfg. Co., the Chicago Rivet and Machine Co., and the Seneca Falls Machine Co.

Associated with Mr. Owen is Stanley Green who holds the position of vice-president and chief engineer. Mr. Green has served in the same capacity for the last fifteen years with the Duncan Electric Mfg. Co.

Mr. Samuel I. Cole, retiring president of Aerovox remains with the company as general manager. Samuel Siegel who was vice-president, remains with the company as director of purchases.

* * *

WHIPPLE JACOBS, president of the Belden Manufacturing Company, recently celebrated his thirtieth anniversary with the company. Mr. Jacobs joined the company as a cost clerk in 1914 and after a short absence from the company to serve in the first World War, he returned to hold various positions in the organizations until his election to the post of president in 1939, upon the retirement of Joseph C. Belden, founder of the company.

* * *

ASTATIC CORPORATION has announced the appointment of two sales managers to handle the company's line of crystal and dynamic microphones, phonograph pickups, cartridges and recording heads.

Mr. Ray T. Schottenberg and Mr. William J. Doyle have been placed in charge of sales, Mr. Schottenberg will act as Sales Manager of the Jobber Parts Division while Mr. Doyle will be in charge of sales to radio set manufacturers.

The company operates plants in Conneaut and Youngstown, Ohio.

* * *

HALLICRAFTERS COMPANY of Chicago has announced the establishment of an employees' profit sharing trust plan. All payments into the fund will be made by the company.

Mr. William J. Halligan, president of the company, explained that the plan will be available to all company employees with three years' service

and will provide a retirement pension, the amount of which will be determined by a percentage of each employee's annual wage. Retirement age for men will be 65 and for women, 60.

Disability and death benefits for employees and their heirs are also included. Military service is to be considered as company service and the time spent in the armed forces will be used to compute eligibility. Hallicrafter employees already in the service are included in the plan.

The Continental Illinois National Bank and Trust Company of Chicago has been named corporate trustee for the plan.

* * *

NATE HAST has joined Lear, Incorporated as merchandising manager in charge of styling and marketing nationally the new line of Lear home radio receivers. Mr. Hast is making his headquarters at 230 East Ohio, Chicago and is organizing the Lear sales staff and making plans for the national promotion of the receivers. Mr. Hast was formerly metropolitan sales manager for Philco and later national sales manager for Emerson. He was the founder and owner of General Television and Radio Corporation before accepting this new position.

* * *

RADIO CORPORATION OF AMERICA has named the newly-organized Ewald Distributing Company of Louisville, Kentucky as the wholesale distributing agency for RCA Victor products in the Louisville area.

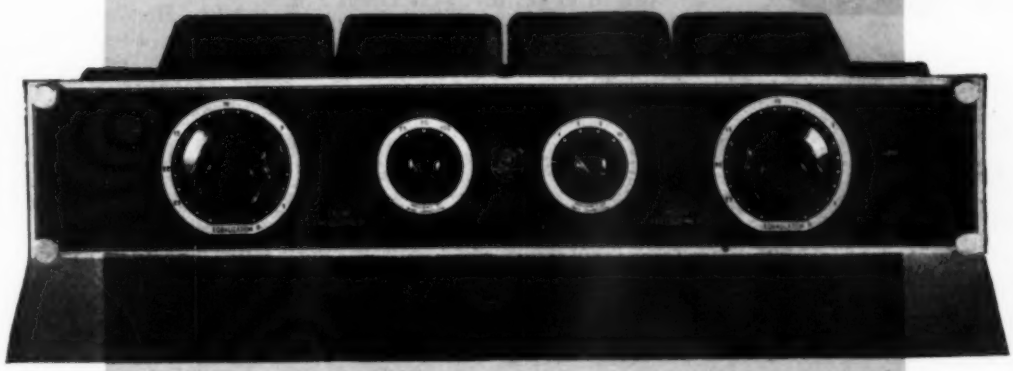
The new company is headed by George R. Ewald, with George C. Collins, Jr. and Arthur Cummins as associates. Mr. Ewald was formerly district sales manager for RCA Victor for eight years in Pittsburgh and Dallas. Prior to organizing the new company, he was manager of RCA Victor's Commercial Sound Department in Camden.

At the same time that the Louisville distributor was announced, the company appointed the George W. Onthank Company of Des Moines, Iowa to act as representatives for RCA Victor products in Des Moines, Davenport, Cedar Rapids and Sioux City.

* * *

CLAUDE LEACH will be in charge of all sales promotion for the newly-created line of Bendix radio receivers, according to the announcement made by L. C. Truesdell, general sales manager for home radios. For the past three years, Mr. Leach has been sales promotion manager for McGreevey, Weering and Howell of New York. He was formerly associated with Sears, Roe-

EQUALIZERS by



3AX . . . THE UNIVERSAL EQUALIZER FOR BROADCAST AND RECORDING SERVICE. PROVIDES ADJUSTABLE EQUALIZATION AT 25, 50, OR 100 CYCLES FOR LOW END, AND AT 4000, 6000, 8000, OR 10,000 CYCLES AT HIGH END. CALIBRATED CONTROLS READ DIRECTLY IN DB EQUALIZATION AND FREQUENCY SETTING. THE INSERTION LOSS EFFECTED BY THE EQUALIZER IS COMPENSATED THROUGH SPECIAL COMPENSATING PADS, SO THAT IT IS CONSTANT REGARDLESS OF SETTING. RAPID CHANGE IN TONE COLOR CAN BE OBTAINED WITH NEGLIGIBLE CHANGE IN VOLUME.

4C . . . AN IDEAL SOUND EFFECTS FILTER FOR BROADCAST AND RECORDING SERVICE. LOW PASS FILTER FREQUENCIES OF 100, 250, 500, 1000, 2000, 3000, 4000, AND 5000 CYCLES ARE PROVIDED. IDENTICAL HIGH PASS FILTER FREQUENCIES ARE PROVIDED. THIS UNIT EMPLOYS NOISELESS SWITCHING, AND A SUFFICIENTLY WIDE RANGE OF FREQUENCIES TO TAKE CARE OF ANY TYPE OF TONE COLOR REQUIRED.

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ALL PLANTS

United Transformer Co.

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buck, and Company, Allied Stores Boggs-Buhl, and Kerns in promotional capacities.

* * *

STROMBERG-CARLSON COMPANY has launched a campaign to interest the public in the advantages of FM radio. The company is distributing two free booklets, "FM—For You" and "Facts about FM" through the company distributors and dealers throughout the country.

"FM—For You" is a fifteen page booklet which traces the history of FM from its invention by Major Edwin Armstrong to the present time. Bearing the official imprint of FM Broadcasters Inc., the booklet, in question and answer form, goes behind the curtain to get the facts about FM, explains what it is and why it operates as it does. The second booklet deals with Stromberg-Carlson's postwar plans to apply wartime developments in h.f communications engineering to the science of improved FM receivers.

Although both booklets are written in layman's language, the material incorporated in the texts is technically and scientifically correct.

* * *

NEAL BEAR has assumed the duties of distributor sales manager for the Radiart Corporation of Cleveland, Ohio. Mr. Bear, who has been in the radio field since 1923 will make his headquarters in Cleveland. As soon as wartime conditions permit, Mr. Bear expects to visit distributors throughout the country to assist them with ther distribution problems. He has been associated with Radiart Corporation for the past seven years.

* * *

ELECTRONIC CORPORATION OF AMERICA has appointed Jack Geartner to the post of sales manager for the company. The appointment became effective January 1st.

Mr. Geartner comes to ECA after five years at Emmerson Radio and Phonograph Corporation as assistant sales manager and advertising director. Prior to that time, he served as general sales manager of Arcturus Tube Company for 12 years.

Plans are now in readiness for the marketing of postwar radios, and information regarding dealer plans and promotions will be announced shortly by Mr. Geartner.

* * *

JENSEN RADIO MFG. COMPANY, through the chairman of the board, Mr. A. Leslie Oliver, has announced the appointment of Thomas A. White to the position of president and general manager of the organization to succeed W. E. Maxson, retired.

Mr. White joined Jensen as sales manager in 1928 shortly after the organization of the company. On January 1, 1940, he was elected to the position of vice-president.

Mr. Maxson, whose retirement was at his request, became president of Jensen in 1940 after ten years with the company. He retains his position on the board of directors.

* * *

ROY S. KERCHER has been appointed to the post of chief electrical engineer for Grayhill of Chicago, manufacturers of rotary and snap-action switches. Mr. Kercher is a graduate of Armour Institute of Technology and has had wide experience in the electrical field. He was previously employed by Furnas Electric Company, Cutler-Hammer, Inc., and in the electrical department of Underwriters' Laboratories.

* * *

SYLVANIA ELECTRIC PRODUCTS, INC. has announced the appointment of two men to their sales organization.

Mr. J. T. Millican has been added to the sales force in the East Central territory for the radio tube division. Mr. Millican will make his headquarters in Cleveland.

Mr. Cortland T. Clark of Seattle, has been appointed manager of the Northwestern Division of the radio tube division. His territory will cover the states of Washington, Oregon, Montana and northern Idaho. He will make his headquarters in Seattle.

* * *

FARNSWORTH TELEVISION AND RADIO CORP. through its president, E. A. Nichols, has announced the appointment of Frank V. Webb as general manager of the company's broadcasting division, including television transmission, FM, and standard broadcasting.

In this capacity, Mr. Webb will assume managership of radio station WGL. He will be assisted in this task by Howard J. Beck who becomes chief engineer of the broadcasting division, including radio station WGL.

Station WGL was recently acquired by Farnsworth from Westinghouse Radio Stations, Inc.

Mr. Beck has been associated with Farnsworth since its reorganizaion in 1939.

* * *

NATIONAL UNION RADIO CORP. has acquired the services of Kenneth McLeod who joined the engineering staff of the company in the capacity of electronic quality control engineer.

Mr. McLeod has an extensive background in the radio field, having been associated with the transmitter installations of several eastern broadcasting stations, as well as research work with Johns Hopkins University, Silver Springs, Maryland.

Prior to joining the staff of National Union, Mr. McLeod was working on war research at Columbia University.

—30—

Piano of the Future

(*Continued from page 27*)

The string side of all 88 pickup condensers is at ground potential and the 88 pickup buttons are connected in parallel in two groups. These individual pickup buttons serve another very useful purpose which constitutes an important advantage over the old type of acoustic piano. One of the serious problems with pianos always has been to get an evenly balanced scale in which the various notes were all of the same relative loudness. With the Dynatone, this scale is balanced at the factory by moving these individual pickups closer to the strings or farther from them. Moving the pickup closer increases the volume of that particular note and farther away decreases it. In this way, a more accurate balance of tone can be obtained than was ever possible in the adjustment of a standard piano.

Two groups are used rather than one to permit the use of a patented balancing circuit to eliminate the pickup of undesirable hum. Because of the high impedance of the input circuit, and the high gain of the amplifier following it, this hum from nearby electric circuits presented a real problem. It was solved by dividing the pickup buttons into two equal parts and by feeding these groups into separate amplifier tubes. After two stages of this dual amplification, the output of the two groups of pickups is fed into the opposite ends of a balanced transformer.

The primary of this transformer consists of a center tapped winding—the two halves of which are carefully balanced. The secondary consists of a single winding. The amplified signal from each group of pickups is connected to either end of the primary winding. The desired musical tones coming from either group of pickups, of course, will be of different frequency since they represent different notes. They will not interfere with each other in the balanced winding, therefore, but will be passed on to the secondary and from there into the other stages of the amplifier. Any hum that is picked up by the input circuit associated with the string pickups will appear equally at both ends of the primary winding of the balancing transformer. Since the voltages caused by this hum will be equal in frequency amplitude and phase, they will buck each other in this balanced winding and will not be passed on to the secondary winding.

The rest of the five-stage amplifier follows good, high-fidelity amplifier practice. The electric amplifier is the heart of the instrument and therefore the complete unit has been designed around it. The amplifier has been designed for the most uniform possible response over the entire range. Triodes have been used throughout to keep the harmonic distortion to the absolute minimum. To fully utilize the tone-quality and output of the amplifier, a massive high-fidelity speaker is used. The frequency response is flat from 30 cycles to 15,000 cycles so that it covers not only the fundamental tones of the entire piano scale but also the harmonics of the highest notes. Push-pull 2A3's are used in the output, giving 15 watts with less than 5% distortion. At a level of 5 watts which is ample for the ordinary sized room in the home, the distortion is less than one-half of one percent.

The last three stages of this amplifier are used also for the audio system of a high-fidelity radio set, for AM and FM reception, and a record player using a high-quality crystal pickup. This pickup is built with a curved arm of tubular aluminum. The curve is so designed that the tracking of the pickup on the record is almost perfect. In other words, the angle between the pickup head and a line running from the center of the record to the needle is almost exactly 90 degrees. This improves the fidelity and reduces surface noise. Weights are provided on either side of the pickup opposite the needle, which counterbalance the needle vibration and improve the bass response.

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Want to repair your own radios—without months of specialized service training? Want to repair sets for friends for fun or profit? Or, if you are already a radio serviceman, do you want to learn how to diagnose radio troubles in 2 minutes or less and fix sets TWICE AS FAST and TWICE AS PROFITABLY—without a lot of unnecessary testing? Then order Ghirardi's RADIO TROUBLE-SHOOTER'S HANDBOOK today—on a 5-Day Money-Back Guarantee!

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Included is a thorough explanation of all Test Instruments, telling exactly how they should be used and why (it even gives complete data for making your own Test Equipment if you prefer!); Receiver Troubleshooting Procedure and Circuit Analysis; Testing & Repair of Components; Installations; Adjustments; etc., etc.,—also, How to Start a Successful Radio-Electronic Service Business. 1300 pages, 720 self-testing review questions, 706 helpful illustrations and diagrams. Only $5 complete ($5.50 foreign).

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without elaborate test equipment

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In addition, there are hundreds of pages of tube charts, graphs, data, i-f alignment peaks for over 20,000 superhets, tube and parts substitutions information, data on transformer troubles, etc.—all carefully indexed so that you can find just what you need in a hurry. This big, beautifully bound HANDBOOK costs only $5 ($5.50 foreign) on our UNRESERVED 5-DAY MONEY-BACK GUARANTEE.

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Address.....

City & Dist. No.....State.....

Provision is made for mixing the record tones with those from the Dynatone strings so that the record can be used to accompany the person playing, or for practice. To make this practical, a variable speed motor is used on the record turntable to permit the record to be brought into perfect tune with the strings.

A microphone can be connected to the amplifier and the sound from this can be mixed with either the record or the string tones. This combination offers infinite possibilities for home entertainment or for use in public places.

The radio covers American broadcast and foreign short-wave bands. The postwar models also will include frequency modulation reception. The radio is designed especially for tone quality and the high-fidelity amplifier which is built in the instrument in which it is used as the audio system of the radio takes full advantage of this feature.

Besides the volume control which affects piano, phonograph, and radio, the three-point switch for the three instruments, and the starting switch with its pilot light, there are separate control knobs for bass and treble, affecting radio and phonograph only since it was not considered desirable to alter the tone balance of the Dynatone after it had been properly adjusted at the factory.

When the "piano of the future" is played without amplification, the strings themselves give a soft, harpsichord-like tone of a very pleasing quality which makes the instrument ideal for practicing, especially at home. As the volume is increased by means of a control provided, any volume level up to that of a full concert grand piano can be obtained. An additional volume control, operated by the "swell" pedal, provides many interesting effects of almost organ-like quality. A chord can be struck and while the strings are still vibrating the "swell" pedal is depressed. This results in an increase of volume which can be controlled in such a way that the results are most pleasing. This feature will be of increasing importance as the musicians become accustomed to using it and its effects are worked into the musical compositions to take advantage of it.

Many musicians who have played this instrument say it is superior to a regular grand piano for many types of music.

The cabinet also has been designed to meet special requirements. In the hollow compartments forming columns at either end of the Dynatone case, are located the amplifier and power supply. The amplifier is in the left-hand side, and the power supply in the right. The loud speaker is mounted behind the grille on the right-hand side of the lower panel. Additional grilles are provided in the two side compartments to give ventilation to the electric equipment.

The Dynatone was introduced publicly before the war and was well received. Several hundred instruments were sold at prices ranging from $595 to $850 depending on the special cabinet finishes and particular type of record changers desired. With Pearl Harbor came complete cessation of its manufacture. As soon as materials are available and governmental restrictions eased, the manufacturer plans to bring out an entirely new model based on the electronic principles of the prewar instrument.

It is quite possible that a television receiver may at the same time be added. Space does not permit any of the present-type of television receivers using large-type cathode-ray tubes but if small tubes of the projection type come into use during the years following the end of the war, means will, no doubt, be found to incorporate this feature also and use the amplifier for the television sound.

—30—

Facsimile

(*Continued from page* 43)

The value of facsimile to any business is only as important as the desire for efficiency and economy. Executives who are satisfied with their present costly interoffice oral communication systems will find facsimile only a convenience. But the majority of business leaders who are opposed to the high expense of garbled orders and buck-passing most certainly will see in this newly developed business aid a means of narrowing the greatest single business waste — errors through misunderstanding.

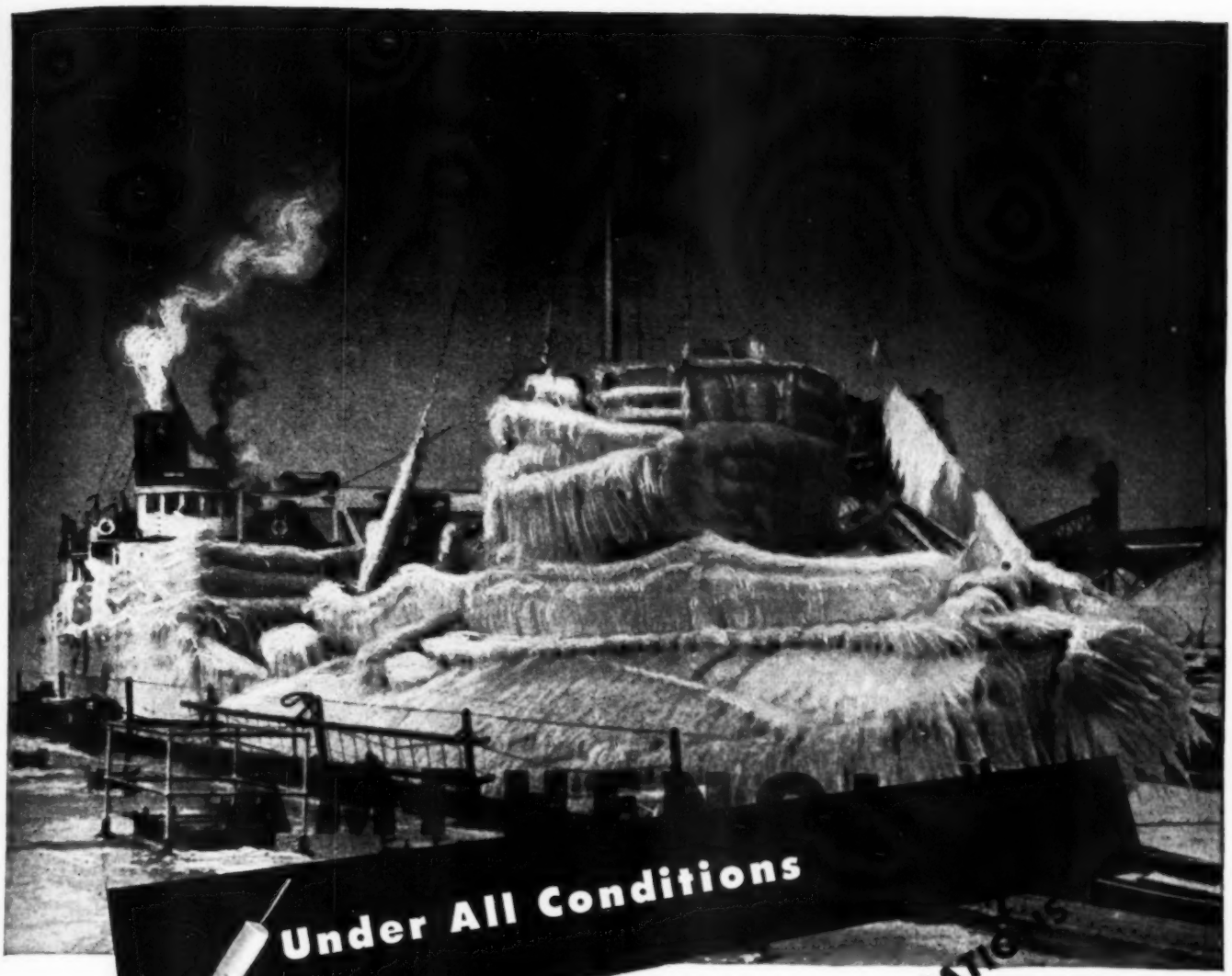
Every message transmitted over this equipment, carries its own written proof. It can be worked with existing telephone or factory-call systems and thereby carries out the "put it in writing" idea. A message can be sent at any time, whether the person for whom it is intended is in his office or not, for it will still be there when he returns. Plain or intricate sketches, office forms, copies of orders or invoices can be handled with uniform ease.

Among the types of industries and professions which already have shown interest in this new aid, are attorneys, banks, breweries, distribution houses, loan corporations, hospitals, insurance corporations, libraries, mail order businesses, manufacturing companies, department stores, railroads, chain stores and restaurants, bookkeepers, and many others.

Aviation

The value of written messages is obvious. Pilot receives facsimile automatically without interfering with beam-frequency reception. Headphones need not be removed. He then has a file of written messages and orders on hand for reference now or later.

Weather maps, storm warnings, barometric readings, wind velocity and



Under All Conditions

CONTRIBUTES TO RELIABLE COMMUNICATIONS

Man's isolation under adverse conditions has ended with recent radio developments which overcome the trying conditions of air and sea transportation. This means rising above all conditions of interference. Among the things that have made this possible is Amphenol *current transmission equipment* that will carry the high frequencies without appreciable loss.

The name "Amphenol" on high frequency cables means the best of polyethylene insulated cable—cable that is sold under affidavit of exacting tests and inspections. "Amphenol" on low-loss connectors means the minimum of loss in tight fitting, secure holding connections. On both it means transmission equipment that will do its part toward providing the clearest possible transmission and reception of communications even under adverse conditions.

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Depend upon
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Quality

U.H.F. Cables and Connectors • Connectors (A-N, British) • Conduit • Cable Assemblies • Radio Parts • Plastics for Industry.

direction, ceilings, and other data are reduced to permanent records. Received maps can cover hundreds of miles of flight as a permanent and safe guide.

Facsimile relieves the pilot for other flying duties. He can write messages or make sketches when and as he pleases. He can transmit his facsimile traffic at any time.

Ships at Sea

Facsimile has decided advantages over radiotelephony, just as the latter has over radiotelegraphy. Harbor tugs, lighters, and other craft can keep in close touch with headquarters, receiving and sending reports. Likewise with fishing fleets. An existing radiophone system can now be supplemented with a means of sending and receiving permanent messages. In tests aboard the "Queen Mary," a series of photographs were successfully transmitted to New York over a distance of 2,900 miles. It is quite apparent that other applications will arise when civilian travel starts again.

Public Utilities

Facsimile has a definite place in railroading, especially supplementing present 'phone dispatching systems. Dispatches can now be in written form, as well as for load dispatching in power networks, and for pipeline control between pumping stations.

Many other uses will suggest themselves to those who can see a place for image communication, with its secrecy, precision thoroughness, and permanency, as a further check on human fallibility.

Police Work

Facsimile meets four cardinal needs: secrecy, orders, fingerprints, identification—quickly, smoothly, efficiently.

It is possible to flash written orders, sketches, identification photographs, fingerprints, and other graphic data over existing police radio, teletype, and wire circuits. If two-way facilities are available, facsimile can likewise be two-way, always without fear of interception by outsiders.

"Put it in writing" has a place in police communications. With facsimile, orders are in permanent form. Policemen on patrol, at precincts or in booths can have before them written rather than oral messages. No need to jot down everything, messages are automatically recorded. A complete file is at hand.

For the new officer on strange patrol, facsimile is invaluable because it permits directional maps to be flashed. State troopers can be sent to new areas because of detailed instructions from headquarters.

Facsimile equipment operates with existing facilities. A mobile unit can be used with present radiophone transmitter and receiver. Regular oral orders can be received, while the facsimile unit stands by, starting automatically for its messages as they come over the same radio system.

Cost of equipment will be well within the reach of even the smallest police force. Simply an accessory to existing facilities, yet it triples the effectiveness of the force in combating crime and handling modern traffic.

With equipment of this type in particular, it is anticipated that facsimile methods will be applied in general communications service in many fields as a postwar objective thereby extending the scope of existing circuits.

-30-

PLUGLESS TELEVISION SERVICE

(Reprinted from Variety)

LIKELY answer to who will pay the initial high cost of television developed recently. It was learned that Scophony Corp. of America is seriously mulling "subscription television" and in time would make sight-sound programs available for about $2.25 weekly. Subscribers would not be bothered by any commercials, programs being all entertainment, news, and sports events. Understood that Scophony recently patented devices making possible this sort of television in the home. Key to setup is an exclusive scrambling device which would keep nonsubscribers from being able to pick up the serviced programs.

Setup for "subscription television" calls for furnishing sets in the home and servicing them for this fee after an initial installation charge (said to be low) has been paid.

According to information obtained, the sets or models used for such television would be the latest improvement of the Scophony set employed successfully in London in 1939. This type would provide a picture 24 by 20 inches in size, comparable to 16-millimeter home motion pictures.

Reported plan of the Society of Motion Picture Engineers to have television equipment for commercial theater use patterned along the lines of current sound and projection booth equipment apparently is in line with Scophony's setup. Its method closely follows the present picture theater projection, most improved theater models differing little from now-used booth equipment and reported nearly as easy to operate.

Regarding the cost angle, reports that theater installations would cost $25,000 to $35,000 brought denial from Arthur Levey, head of Scophony Corp. of America. He said that, based on London experience, theater installations for the average house should not exceed a maximum of $7,500. Levey indicated that it might run higher for the larger theaters or where special engineering problems were encountered.

Paul Raibourn, a director of Scophony and treasurer of DuMont Labs was in Washington during the hearings by FCC which were held on radio and television allocations.

-30-

Portrait of a man who no longer cares about the cigarette shortage, the meat shortage... or gas shortage!

It's just a question of time when all shortages will be replaced by plenty—thanks to this boy and to millions like him.

Give them a helping hand.
Buy Bonds — Donate Blood.

We, the management and employees alike, at Kenyon, are building better transformers than we ever built before — and building them faster for the armed forces.

THE MARK OF EXCELLENCE

KENYON TRANSFORMER CO., Inc.

840 BARRY STREET
NEW YORK, U. S. A.

····· LETTERS ·····
FROM OUR READERS

MORE ON SCREWDRIVER MECHANICS

"IN YOUR August, 1944 issue, Sam Berger's letter on the subject of screwdriver mechanics interested me very much.

"I consider myself quite capable of repairing the most modern receiver with the most elaborate test equipment, but I never expect to go into the radio servicing business, so I cannot be considered as future 'competition.'

"At the present day, of what value could licensing be other than eliminating competition? A good man should never fear competition. Go out into the world and build yourself a reputation and there will be none better than one earned through many satisfied customers.

"I am in favor of licensed trades where faulty work is of danger to the public. To me a radio serviceman's license would be of no more value than a union card.

"I would like to hear the opinions of others and consider their viewpoints."

T/Sgt. K. Klatt,
Somewhere in France

"IN REGARD to the 'screwdriver mechanic,' I would like to ask Mr. Berger and others with the same attitude, if they ever went through the 'screwdriver mechanic stage,' or if they were born experts? Also if these born experts would not like to see RADIO NEWS discontinue articles written by Ghirardi and other noted men of the radio field.

"I personally believe the average 'screwdriver mechanic,' really studies these articles and derives a great deal of good from them. I know that I study them all even though I have been to several good schools. At present I am employed in one of the most important war jobs in this good old U.S.A. as an electronic trouble shooter with a rating of A-1, the highest rate obtainable, where the latest scientific instruments are used, and take it from me, I went through the 'screwdriver mechanic stage,' and have plenty to learn yet.

"Quite frequently I run into a radio service job put out by some of these noted experts, that would bring shame to a novice.

"For my part I can get enough work without demanding that the public bring it to me, just because I can explain the electronic theory and undoubtedly could secure a license.

"Let us finish the 'Big Job' of winning the war of 'Freedom.' When the big job is completed, you'll find me at the service bench with Rider's manuals, oscillograph, signal generators, channel analyzers, etc. and not worrying about the novice.

"Let's thank God for a free country and magazines like RADIO NEWS."

Lyle C. Newell
Oak Ridge, Tenn.

"I WISH to state that I am quite a fan for your book RADIO NEWS. There is only one kick I have to offer.

"In my tent there are five radio men and we were fairly amused at Mr. Samuel Berger's letter about 'screwdriver mechanics.' I wonder just where he got his start? He claims to have been in radio for a period of 15 years. He states that radio servicemen should pass a test four times a year in order to repair sets, and that screwdriver mechanics are a menace to all 'legitimate' radio men. This amuses us over here quite a lot. There are radio mechanics up front who never saw television and can service circles around this great radio repairman.

"So all we have to say is this: if he's so smart then why does he want each and every part numbered and marked, a full schematic of all circuits and stages, and technical bulletins on each stage. If he's so worried about us, and cannot keep up with all the additions to radio as they come out from time to time, then he should close his shop (if he has one) and go home. The letter we speak of came out in the Overseas Edition for the Armed Forces."

S/Sgt. M. Vascoe,
T/3 Allen D. Nutter,
Pvt. Oden L. Long,
Pvt. Thomas E. Sandoval,
Somewhere in Italy.

"WE SINCERELY believe that there exists the necessity for the licensing of radio servicemen and that the present developments in electronics warrant such action in the near future. The men who have, and are now operating an honest radio servicing business have thought of this matter at one time or another, but have waited until someone made an issue of it.

"Experience would seem to indicate that the objection is not so much about the quantity of the work done by the screwdriver mechanic as the damage he inflicts on the reputation of servicemen in general by inferior workmanship and unethical business practices. It is not necessary for any of us who have been in the business to cite instances where an unqualified serviceman has made it expensive for Johnny Q. Public and tough on the qualified man.

"The men who have been in business for the past ten or fifteen years have had to compete with everyone who has had a smattering of the principles of radio which resulted in cut-

THE BUSINESS OF

CROWE NAME PLATE &
MANUFACTURING CO.

IS NOW KNOWN AS

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INCORPORATED

MANAGEMENT, PERSONNEL
FACILITIES, DESIRE TO SERVE
AND THE PHONETICS OF THE
NAME REMAIN UNCHANGED

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3701 RAVENSWOOD AVENUE
CHICAGO 13, ILLINOIS

OVER 40 YEARS EXPERIENCE
IN FINE METALCRAFT. A SELF
CONTAINED PLANT WITH
OVER FIVE ACRES OF
MANUFACTURING SPACE

throat practices. This not being enough, we have had to contend with the so-called 'serviceman' pursuing a gyp occupation.

"Licensing radio servicemen is not going to change the type or quantity of equipment necessary to test and repair radios, it is only going to separate the technically qualified from the unqualified. It will establish a recognized profession capable of giving the public the proper service and exacting fair remuneration.

. . . "The suggestion of Mr. Devaney regarding Associate Membership in the IRE and possibilities of forming a separate division in that organization at some later date meets with our hearty approval.

. . . "It is not necessary for this to become a 'political football' any more than the licensing of radio operators. It should be a Federal License, issued by the FCC or similar government agency. The examination could be prepared by an appointed committee of recognized authorities on radio servicing.

"Inasmuch as legislative action will be required to inaugurate such a plan it will be necessary to enlist the aid of such organizations as the Radio Manufacturers Association and also the Institute of Radio Engineers, as only these bodies can possibly wield sufficient influence to interest the legislators in the problem.

"This should not prove difficult since it is of the utmost importance to the manufacturers that their equipment be maintained in the condition of operation for which it was designed. Also it would be a source of unending satisfaction to any good engineer to know that the ultimate user of his contrivance has been properly informed on its manual operation."

Lt. Harold L. Cole,
Lt. Robert L. Frazier,
Lt. Stuart M. Hayes,
Lt. John J. Wahle,
Boca Raton Field, Florida.

"AS FOR the 'Screwdriver Mechanics vs. Licensee' feud, I certainly agree with Mr. Willoughby and Mr. Pilgrim on the theory that it is up to the public and not the serviceman who repairs the sets.

"In our town, it is a different matter, as there are only two servicemen, who are good friends (one of them is a screwdriver mechanic, incidentally) and they consult with one another and never squabble over the matter.

"Mr. Berger and his licensed friends must remember that they are not the only pebbles on the beach. Also, the licensed man sometimes isn't the only one who knows something about radio. I have seen screwdriver mechanics get work that had been taken to licensed 'experts.'

"Also in reply to Mr. Devaney's letter, he calls the screwdriver mechanic a 'saw and hatchet man.' Why should he kick?

"Any work the screwdriver mechanic cannot do, he gets. Anyway, Mr. Devaney was probably a screwdriver mechanic at one time, and as this is a free country, he should give everybody a chance.

"In closing may I repeat Mr. Pilgrim's very wise phrase, 'Let's worry more about the work we do, than about the work we think some screwdriver mechanic is getting'."

Bill Gordon
Oxbow, Sask., Canada

"P.S: Congrats on your Signal Corps issue."

"RECENTLY I was fortunate in getting hold of an August RADIO NEWS and noticed with interest the letter by Samuel Berger.

"Before the war I worked eight hours a day and six days a week servicing all makes of radios, sound systems, and other electronic equipment. I have been in the game six years, plus three in the army.

"I am in charge and responsible for all the radios used in this outfit and you may rest assured that we have plenty. During my travels in my life I have had the opportunity to visit many radio shops all over the States, England, etc., and in my opinion radio servicing lacks dignity.

"If a radio serviceman has put in many hours of study and has expensive equipment, why shouldn't he capitalize on this? Most shops are dirty and poorly laid out. This is an electronic age, so let's take our profession out of the back room and make it something to be proud of. The inefficient and 'screwdriver mechanics' will cook their own goose if we have something to offer customers which will give them confidence. Let's eliminate such stabs in the back as the 'Reader's Digest' once gave us. I don't believe the profession should be licensed.

"An organization should be set up of those who actually are in radio as a business to recognize those in the business. A new business should be put on probation until it is demonstrated that the serviceman is earnestly trying to offer a service to the public. Any examination can be passed by those who 'bone up' so it would be possible for a man to secure a license without knowing how to repair a set properly.

"All radios should have a manila envelope clipped inside the cabinet containing all the circuits, model numbers and servicing suggestions."

Sgt. Walter H. Aipten
Somewhere in Luxembourg

"I HAVE been following with great interest the articles on the 'screwdriver mechanic.' If I may, I would like to put in a word or two.

"We can not afford to ignore the threat that they bring to the industry. Of course, they pass quickly, but not until they have smeared all of our names. None of us want to do away with the competitive business system we now have. At the same time, however, we must suppress the incompetent, cut-throat menace of Bill Tinker.

Meet the Men

WHO USE YOUR BATTERIES!

The Navy and Merchant Marine send rapid ship-to-ship messages by battery-powered flasher signal lights when radio communication might give a ship's position to the enemy.

It's difficult to locate men drifting in the sea! Water-tight battery lights on buoyant lifesaver suits have meant the difference between life and death for many Merchant seamen.

For emergency communication by voice, the Merchant Marine uses a portable megaphone to broadcast orders and instructions. Dry batteries give necessary power to the megaphone.

Two men and a bazooka make a winning team! But it takes large quantities of ammunition and dry battery power to keep these portable, hard-hitting weapons firing at the enemy.

Deadly flamethrowers are blazing the road to Victory! Dry batteries help to create the spark that sends these efficient weapons into instant, flaming action against the enemy.

The Signal Corps man with a Walkie-Talkie has freedom of speech as long as he has plenty of dry batteries! Handie-Talkies also use thousands of war batteries to power vital communications.

When they come Home —Burgess Batteries will be back again, too... powering flashlights, telephones, radios, instruments and controls for millions of homes, farms and industries throughout America.

BURGESS BATTERIES

IN THE NATION'S SERVICE

BURGESS BATTERY COMPANY, FREEPORT, ILLINOIS

"What we need is a license that will once and for all prove our abilities to J. Q. Public. However, what good will such a license do if it isn't able to back us up? It must have the power to keep the beginner out of the field until he has been molded into a capable technician.

"A license will not keep those who really want to get into the field from doing so. Most of us either attended an accredited school or after a long period of home study began to service under the experienced tutoring of the serviceman in our neighborhood.

"Would John Q. Public let a freshman in premedical school prescribe for his aching head? No. He knows the difference. Would he let the youngster who once built a crystal set work on his FM converter? Yes! He doesn't know the difference. So what do you say we show him the difference?

"It seems to me that any man who calls the proposed license unjust is just worrying about what the examination for such a license would show. Surely no capable man is unwilling to prove his ability.

"Those of you who are carrying on the work so splendidly in the face of existing shortages and those of us who are going back to our own shops when the jiujitsu experts are put where they belong ask only for a chance to make a decent living. What right do the 'condenser checkers' possess that enables them to hinder this right.

"How about those gallant men who paid the supreme price for our Free Way of Life? All they were asking for was this right. That is what they fought for. You can bet your last 12SA7 that no red-blooded American is going to take that on the chin.

"So let's get those licenses out and give the men who have earned it the right to make a living."

Robert M. Shenberger
Radio Operator, USMM, At Sea

"I AM 100% in favor of Federal Licensing of radio servicemen.

"I think the biggest reason some servicemen are against it is that they themselves are just 'screwdriver mechanics' who charge big prices for inferior repair work and are afraid that they would be eliminated if licensing were started.

"If these 'screwdriver mechanics' were removed from the trade, they probably would find some occupation that is much more suited to their talent, and they would thus stop pestering radio owners, and good radio servicemen with their screwball radio repair work."

Marvin Tutt,
Jacksonville, Texas

-30-

RADIOTELEPHONE UNIT PROVIDES EMERGENCY COMMUNICATIONS

TO meet the need for establishing and maintaining instant and reliable communications in cases where floods, fires and other emergencies have cut normal communication channels, the Rock Island Lines are using transmitting and receiving units designed and manufactured by the Galvin Manufacturing Company of Chicago for this purpose.

The picture shows one of the emergency units on the top of a Rock Island truck. This equipment, powered by battery or gasoline generated power, permits radiotelephone communications to be set up and maintained over gaps in regular dispatching circuits up to a distance of 30 miles.

Installation is simple. The unit which is self-contained, is transported to the scene, the antenna is installed, either directly on the ground or on some convenient elevation, and the unit will operate unattended for a period of days or weeks. Two-way communication may be established with a corresponding unit installed at the distant point. -30-


People in the Know
are Saying...
Keep Your Eyes On Belmont
The American people expect great things from post-war radio and television. And Belmont is planning to fulfill these expectations.
You can confidently look forward to Belmont FM Receivers that virtually eliminate interference and static... to Belmont Television Sets that bring in clear and greatly enlarged pictures... to Belmont Standard Wave Radios that offer many important improvements and refinements... to a great line of Belmont Phonograph, Radio and Television Combinations.
All of these developments will come when Belmont's war job is finished. But as long as the Armed Forces require production of high-precision electronic equipment, Belmont will concentrate on turning it out... with all our facilities. Belmont Radio Corporation, 5929 W. Dickens Avenue, Chicago 39, Illinois.
Belmont Radio
RADAR ★ TELEVISION ★ FM ★ ELECTRONICS

Communications Airborne

(*Continued from page* 34)

be carried on the person of the parachutist as he drops, plans are made so that it is dropped by parachute at the time the signal personnel are dropped or just before their leap from the plane.

When the set had been parachuted on various maneuvers and tactical problems, it was found on landing to be damaged and sometimes beyond use to the unit when they set it up to begin functioning.

The Test and Development Section of the Airborne Center hit upon a cedar chest delivery type container into which they could load the set (in sufficient padding to prevent its breaking on hitting the ground) in broken down sections along with spare batteries.

The set is loaded into this chest along with a companion chest and both are placed in the end caps of an A-5 Aerial Delivery Container and then dropped. Both sets have functioned perfectly after this drop on maneuvers and still continue to be used.

In addition to increased power and capability of being dropped by parachute, the SCR-284 is much more flexible than the SCR-536 in that more frequencies are available to form different nets within the Airborne Division, and it has the additional advantage of being able to send c. w. signals (keyed transmission as well as voice).

Coming back to the paratrooper, we find that he favors the SCR-300 mostly because of its many advantages to the trooper when he has to have communications and has to have it in a hurry.

The SCR-300, as seen from the accompanying photographs, can be adjusted to the personal whims of the paratrooper and can be added as part of his regular equipment when he jumps. The canvas case is constructed of heavy duck completely waterproofed and pliable enough after submersion to allow for easy removal.

The harness straps are made of heavy duck webbing and are made wide enough to allow some degree of comfort for the man and also are of sufficient tensile strength to permit some heavy punishment.

Let us suppose that the paratrooper this time is an engineer and his unit has been given the task of preparing a bridge for demolition because if it were captured, it would permit easy access to our supply dumps for the enemy.

As he hurtles from the Troop Carrier command ship, the one thought of this paratrooper is to get on the ground safely but quickly, and to get his set in working order so that he can start receiving orders from the battalion command post and transmitting them to the lower units which have jumped with him.

Quickly shedding his harness and grabbing his M1 rifle as he scrambles out of the harness, he hustles to the protection of some trees a few hundred yards from the drop area and here he can observe what is going on about him.

The warning signal has been given by the men around him and he knows he has friends nearby even though he may be in enemy territory. The order is given to assemble all elements and slowly but cautiously move toward the assembly area.

Pretty soon the paratrooper's set begins to function and he gets the raspy voice of the corporal back at battalion and the orders start coming through.

"Tell those honeydippers to stand by; the Captain thinks that we may not have to blow the bridge as the Infantry is giving those guys up ahead a lot of hell and they'll hold 'em."

With this crisp order under his belt the signal man passes it along to the sweating, harried platoon commander. He is greatly relieved, for with his communications functioning perfectly and his bridge all set to go when given the word, the most important part of his work is done. Cautioning his men to be on the alert, he snakes his way toward the signal corporal and remains beside him waiting for the word to blow the bridge.

We have demonstrated the need and suitability of these radios for airborne operations. Some, of course, will be more desirable than others, or the particular paratrooper using same will prefer one to the other for his own particular reasons.

Several factors stand out, however, in the selection of radios for all airborne operations, and these must first be considered when the signal unit of an airborne operation goes into combat.

Of the three radio sets described above, the SCR-300 seems to stand out as the one most preferred by these troopers who have to consider weight and the ability to progress fast in a rapidly moving situation.

In addition, the range of this set is more than some of the others, the harness is especially suited for parachute work, or it can be fitted with a packboard, if necessary, for long hikes.

In situations where a man has to crawl along on his stomach for any great distance and still be able to communicate with his other echelons, a second flexible antenna is available so that he still can creep, his antenna can remain rigid and he can maintain communications. Or if he has to remain in a fox hole for any length of time, the antenna is long and flexible enough for him to move about and still keep it above ground.

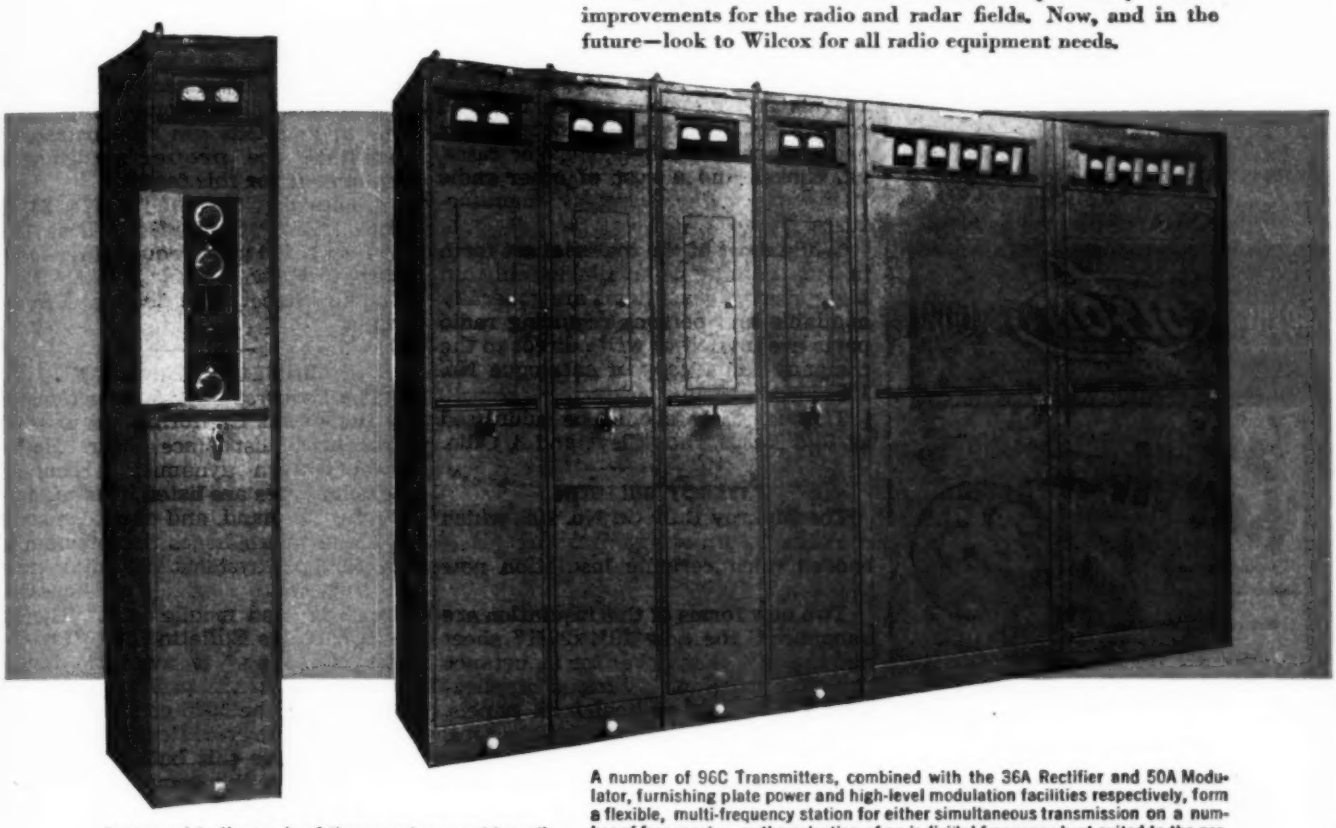
It is a one-man set essentially, and anyone can operate it since no code is necessary and should the man originally assigned to the set get shot by a sniper, any other man of the unit with reasonable intelligence can master the operation of the set.

—30—

Look to Wilcox for Quality

...IN RADIO COMMUNICATIONS EQUIPMENT

For many years, the quality of Wilcox communications apparatus has been relied upon by broadcasting stations, commercial airlines and governmental agencies. Throughout the United States and over the world flight schedules have been accurately and safely maintained through use of Wilcox ground and aircraft transmitters, receivers and control equipment. From the urgency and new demands of war have been developed many Wilcox improvements for the radio and radar fields. Now, and in the future—look to Wilcox for all radio equipment needs.



A number of 96C Transmitters, combined with the 36A Rectifier and 50A Modulator, furnishing plate power and high-level modulation facilities respectively, form a flexible, multi-frequency station for either simultaneous transmission on a number of frequencies, or the selection of an individul frequency best suited to the particular communication problem. The use of an individual channel for each frequency avoids the complications of frequency shifting mechanisms.

Engineered to the needs of those services requiring reliable radio communinications, the Wilcox Electric Company 96C equipment represents an advanced stage of design in the field of medium frequency, medium power transmitters. Each unit is a complete, fixed-frequency 2.5 KW RF transmitter, for either telegraph or telephone operation in the range of 2-20 MC.

WILCOX ELECTRIC COMPANY, INC.

Manufacturers of Radio Equipment

Fourteenth and Chestnut Kansas City, Mo.

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented

MASTS AND TOWERS

The *Harco Steel Construction Company* has issued a catalogue covering their new line of masts and towers.

Complete specifications, construction details and illustrations of ten different types of towers are given to facilitate the selection of proper equipment for the work to be performed.

These towers are characterized by ease of installation due to the sectional construction which permits easy erection in a short time.

A copy of this catalogue will be sent to executives and engineers upon request on their business letterhead. Address the company at 1180 East Broad Street, Elizabeth 4, New Jersey.

BUD RADIO CATALOG

The *Bud Radio, Inc.* of Cleveland has issued a new catalogue of radio parts which will be forwarded upon request. In this 58-page booklet are included condensers, chasses, cabinets, relay racks, panels, brackets, speaker cases, r.f. chokes and a host of other radio items which the company manufactures.

While most of the material set forth in this catalog is available only on high priority, some items are generally available and persons requiring radio parts are invited to write direct to the company for a copy of catalogue No. 105.

The company should be addressed as *Bud Radio, Inc.*, Cleveland 3, Ohio.

MYKROY BULLETIN

The Mykroy Bulletin No. 102, which contains information regarding glass-bonded mica ceramic insulation now is available for distribution.

Two new forms of this insulation are announced, the new 19¼x29¾" sheet and the 29½" heavy bar for inductance coil construction. Various applications, including switchboard panels, inductance bars, insulated table tops, large meter panels, transformer covers, switch connecting rods and bases for r.f., and electrical equipment assemblies and structural members of r.f. equipment are described together with the pertinent data which is furnished.

Copies of this bulletin will be forwarded upon request to *Electronic Mechanics, Inc.*, 70 Clifton Boulevard, Clifton, New Jersey.

L & N TEST EQUIPMENT

An informative 8-page catalogue, of interest to manufacturers of electrical equipment is being offered by *Leeds and Northrup Company.*

The catalogue, entitled "To Measure Insulation Resistance—L & N Test Set Assemblies," provides information on test procedures for wire, cable, instruments, motors, appliances and insulating materials.

Two assemblies, one designed for use on the production line and the other for laboratory use, are described fully.

Copies of this catalogue, E-54-460 (1), will be forwarded upon written request to *Leeds and Northrup Company,* 4934 Stenton Avenue, Philadelphia 44, Pa.

WIRING BULLETIN

Aircraft-Marine Products, Inc., is offering a new 18-page bulletin to aid production designers, engineers and production men with the problem of equipment wiring.

This booklet features the company's line of knife-disconnect, solderless terminal and splicing components. Various applications are demonstrated to facilitate the proper designing of equipment for this feature.

Copies of this bulletin, No. 33, entitled "AMP Simplified Wiring" will be forwarded upon request to *Aircraft-Marine Products, Inc.,* 1591S North Fourth Street, Harrisburg, Pennsylvania.

UNIVERSAL PRICE LIST

The Universal Microphone Company of Inglewood, California has issued its first price list since Pearl Harbor. Twenty-seven dynamic, carbon, and velocity types are listed in palm, stand, throat, lip, hand, and cartridge styles.

These microphones are adapted for aircraft, p.a. systems, recording, transmitting, call systems, interphones, police radio and mobile uses. The list, designated as Bulletin 1460, "Pre-Catalogue Listing," is available for the commercial trade preliminary to the issuance of the 1945 commercial catalog of all *Universal* items.

Request for this bulletin should be addressed to the company, *The Universal Microphone Company,* at Inglewood, California.

1945 WALSCO CATALOGUE

Five hundred items manufactured by the *Walter L. Schott Company* for the users of radio, electrical, and communications equipment, are listed in the new 1945 Walsco catalogue which is available now.

The first half of the catalogue is devoted to radio chemicals, such as cements, lubricants, adhesives, varnishes, lacquers, polishes, and refinishing kits while the second part of the catalogue covers radio and electronic

hardware, including dial cables, trimounts, cable clamps, grommets, and other accessories used by industry, laboratories, and radio repair shops. Most of the items listed in the catalogue are available without priority.

Many of the company's new products are listed along with the more familiar items of their manufacture.

The catalogue 45 will be forwarded to those requesting it of *Walter L. Schott Company,* 9306 Santa Monica Boulevard, Beverly Hills, California.

PYROMETER BULLETIN

The *Elematic Equipment Corporation* has just issued a four-page bulletin covering the features and operation of their Model 40 portable, high-resistance pyrometer.

This unit is a direct reading, precision instrument for checking radio crystals in sub-zero ranges. Accurate within 1½ degrees, the unit embodies many new features designed for this pyrometer.

Both standard and custom-built instruments for special applications are described in this bulletin, copies of which may be obtained by writing direct to *Elematic Equipment Corporation,* 6046 Wentworth Avenue, Chicago 21, Illinois. Specify Bulletin 40.

DURONZE MANUAL

A revised edition of the 80-page Duronze Manual has been issued by the *Bridgeport Brass Company,* containing specifications and technical data on five outstanding copper-base engineering alloys. Many examples of product improvement through the use of high-strength, corrosion-resistant Duronze are discussed and illustrated.

One of the outstanding products discussed is the alloy known as Duronze III. This is an aluminum bronze which is modified by silicon. This process produces a material which is approximately 50% stronger than brass, 9% lighter in weight, and exceptionally resistant to severe corrosion. Because of its low coefficient of friction when in moving contact with steel and most other materials, it is suitable for gears, pinions, bushings, valve stems, and similar items. Duronze III can be machined from 60 to 70% as fast as free cutting brass rod.

This revised manual includes technical data and other information on Duronze alloys in sheet, strip, rod, wire, and tubing forms. A copy of the manual will be forwarded free of charge when a request is made on company stationery to *Bridgeport Brass Company,* Bridgeport 2, Conn.

H.F. IRON CORE DATA

A new bulletin which provides practical data on the uses and functions of powdered iron cores; the permeability and "Q" of various materials at different frequencies; and the effects of the addition of adjusting screws, now is available to designers and engineers of electronic equipment.

This bulletin, which is issued by *Henry L. Crowley and Company, Inc.,* contains 34 pages of engineering material which will assist the designer in determining the product needed for specific requirements of size, mechanical considerations, and other pertinent material.

Distribution of this bulletin is limited to those actively engaged in designing and producing commercial radio and electronic equipment. Requests for copies of the bulletin must be written on company stationery and mailed direct to *Henry L. Crowley and Company, Inc.,* 1 Central Avenue, West Orange, New Jersey.

TUNGSTEN CATALOGUE

A 12-page catalogue covering the history, properties, manufacture, and uses of tungsten is available from *Cleveland Tungsten, Inc.*

The story of tungsten, which is the hardest of all metals, is an interesting one and this booklet presents the historical background leading to its discovery and application. The story is written in popular style and will be of interest to the layman as well as the engineer.

Specific applications and properties of tungsten are outlined along with the steps in the manufacturing process.

Copies of the catalogue will be forwarded upon request to the *Cleveland Tungsten, Inc.,* Cleveland, Ohio.

FIBERGLAS INSULATION

The uses of Fiberglas for various types of electrical insulation are described in a new 24-page booklet just released by the *Owens-Corning Fiberglas Corporation.*

Fiberglas is available in many forms, including tapes, cordage, braided sleeving, cloth, varnished cloth and tape, laminates, saturated sleeving, and varnished tubing. Data concerning the various applications is provided in this booklet in order to supply the engineer with design and application material. Performance charts are included also.

Copies of the booklet, Catalogue No. EL44-7, are available from *Owens-Corning Fiberglas Corporation,* Bureau of Industrial Service, Inc., 285 Madison Avenue, New York 17, New York.

PEERLESS CATALOGUE

Copies of the new 20-page catalogue covering the fields of radio, sound, public address, television, and electronics, now is available for distribution, according to a recent announcement made by the *Peerless Electrical Products Company.*

The catalogue contains photographs, illustrations, construction details, and prices of the line of *Peerless* transformers, windings, and reactors.

The catalogue is available to industry personnel who address their request on company letterhead to *Peerless Electrical Products Company,* 6920 McKinley Avenue, Los Angeles 1, California. Specify Bulletin 431.

—30—

Servicing Auto Radios

(*Continued from page* 30)

condenser, for example, might easily ruin a good replacement vibrator.

Due to the rapidity of the pulsating current in the vibrator section of the power supply, adequate shielding of all leads leading to the unit must be provided. If r.f. choke coils and by-pass condensers were not inserted, then the relatively long battery leads would serve as transmitters of alternating-current fields which would directly affect the antenna of the radio receiver. In Fig. 1 we have the diagram of a power supply, complete with the necessary filters. This circuit is typical of those found in more recent auto sets. As sets become more sensitive, as they have recently, then the shielding required must become more proficient.

Servicing Power Supplies

In dealing with the troubles that befall auto radio power units, it is possible to group them broadly into two classes. In one class we find that the entire unit fails and no "B+" voltage is available for the receiver. Into the other would fall those troubles that would cause lowered "B+" voltages, hum, vibrator interference (hash), or noisy operation. Those of the first class are usually easier to locate and so will be analyzed first.

When a set is brought in which is completely inoperative, it is best to determine whether any direct shorts exist before a test storage battery is connected. This is a safety measure that may prevent damage to either the set or the storage battery. A short in the primary circuit can usually be traced to either the vibrator or a shorted condenser (if used) across the entire primary winding. See Fig. 1. The trouble thus may be located quite simply.

If the short is in the secondary circuit of T_1, then a good indication would be obtained by measuring the input current from the storage battery. If this exceeds the value given by the manufacturer by one or two amps, then the indication may be taken as positive. The short circuit may be either in the buffer condenser across the secondary, an electrolytic condenser, or in the set itself. The serviceman should be able to locate these in a short time. The excess input current, due to this short, should not be allowed to flow for any appreciable length of time. It can quickly overheat the vibrator reed, causing it to lose its elasticity and stick.

The above are the common causes of no output voltage if a short circuit is present in the unit. If tests on the auto radio reveal no shorts, and still there is no output voltage, then the fault may lie in one of several places. The following lists the more common causes of no "B+" voltage:

1. The 0Z4 rectifier tube, if one is used. This tube requires a certain

minimum voltage acting on its plate before the tube will start to function. A low storage battery voltage can thus be the cause of nonoperation.

2. A defective or "worn-out" 0Z4.

3. If an 84 tube is used, it may light up and still have no appreciable emission.

4. A break in the wiring due to either corrosion or as a result of the constant motion of the vehicle. This can happen in either the primary or secondary circuits.

5. An open filter choke.

The remedy to all the above is self-evident and requires no further explanation. With regard to the above mentioned 0Z4 rectifier tube, many servicemen generally replace this with a 6X5. The latter has been found to last longer and has proven less troublesome. The same socket may be used for the exchange and many sets come equipped with the extra heater connections already wired in for such a change. The heater connections necessary here are obtained quite readily. One prong is grounded at the socket, the other lead going to the center tap of the primary winding.

The second class of possible troubles in the power section of the auto radio is concerned with lowered "B+" voltages, hum, and noisy performance. Low "B+" voltage may be due to:

1. Weak battery.
2. Worn out vibrator.
3. Poor emission of rectifier tube.
4. Filter condenser with large leakage current.
5. Intermittent short of buffer condenser across secondary of the transformer.
6. Excess current being drawn by a partial or low-resistance short in the radio set proper.

None of these has been listed in any order of importance. Each set is a new problem when it comes to the above types of troubles.

Hum and noise may be due to any of the following:

1. Vibrator hash due to open buffer condenser. It may even be due to a buffer condenser of the wrong value.
2. Metallic cover of power unit or set not making good electrical connection with ground. The set is thus incompletely shielded.
3. Position of leads carrying pulsating primary current.
4. Faulty filter condenser.
5. Mechanical hum due to vibrator coming in contact with other parts, physically. Once found, this can be easily corrected by inserting cardboard or friction tape between the vibrator and the other part.
6. Intermittent hum or noise caused by a lead making and breaking contact, especially when car is in motion.
7. Sometimes a small paper condenser is placed across the rectifier filament. This may be open.
8. Broken leads in vibrator. This is a particularly vulnerable point.
9. Screws holding metallic shields in place have worked loose. This

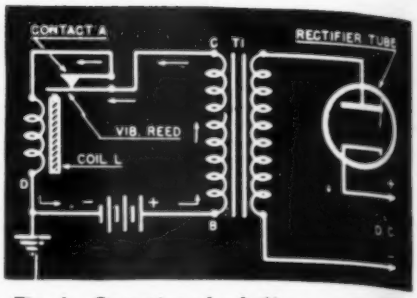


Fig. 4. Operation of a half-wave vibrator.

again provides poor ground connections which are so vital for satisfactory set operation.

10. An r.f. filter condenser becomes open.

While the above represent the most important sources of hum and other disturbing noises, no hard and fast rules can be laid down for their correction. One method that has proved helpful consists in first determining whether the source of the noise is due to either an electrical or a mechanical cause. This can be done by moving the set while it is in operation. Intermittent disturbances can usually be quickly found this way. If no loose contacts come to light, then each r.f. choke and its by-pass condenser in the power unit should be tested. This may take some time, but it is the only course that seems to work all the time.

In closing, mention should be made of the fuse that is located in the "hot" lead to the storage battery. While a blown fuse is frequently indicative of a short circuit somewhere in the set or power supply, it may also occur if:

1. The insulating sleeve over the fuse accidentally becomes grounded. This places the fuse directly across the "A" battery.
2. The vibrator has a tendency to stick. Replace with a new vibrator.
3. The filter condensers in the "B+" filter section of the power supply have a voltage rating that is too low. This type of trouble is noticed most frequently when the set is warming up. The voltage across these condensers is then at its greatest because the set (receiver tubes) has not been heated sufficiently to draw current. Once the current starts to flow, the voltage generally drops. The only solution to this problem is to replace the old condensers with others having a higher voltage breakdown.

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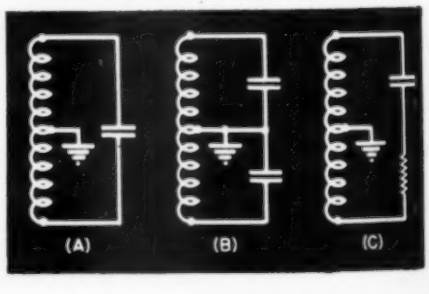
Fig. 5. Three generally used methods of connecting buffer condensers across the secondary of the power transformer.



TO thousands of service engineers here in America, Mallory owes a debt of gratitude. For a long time now many of you have preferred to use Mallory Vibrators. But quite often during the past two years, our distributors have been unable to fill your orders.

Of course there has been good reason for this. With the outbreak of war, radio components for military use were needed in enormous quantities. Quality considerations too, were of the utmost importance.

Our vibrators were able to meet the most exacting tests. We were also the largest producers. As a result, our facilities were taxed to the utmost; we were unable to keep up with civilian demands.

We think you will be glad to know that today Mallory vibrators are in planes, tanks, portable radios and many other types of equipment on every fighting front. Not only are they serving American forces, but those of all our allies. These are the vibrators you did *without.*

Now, with production several hundred percent greater than in 1942, Mallory vibrators are again available for civilian use. Always noted for dependable performance, they are today even better *than ever.* So look for the familiar orange and blue carton on your distributor's shelves. You've had a long wait for Mallory vibrators—but the wait has been worth while!

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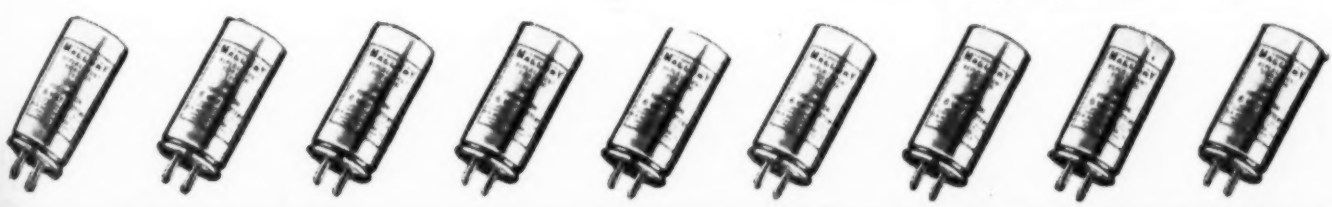
Distribution of Mallory vibrators is being made as rapidly as possible. If your distributor has not yet received his supply, please bear with him.



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Spot News

(*Continued from page* 98)

cations (other than broadcasting); FM broadcasting, facsimile, relay systems and television; aeronautical radio and radio aids to navigation; and industrial scientific and medical.

The panel will study problems as we did here and formulate a program of allocations that will be submitted to the international conference when such a conference is held. The domestic allocation program will be submitted to the radio division of the Canadian Department of Transport who will probably issue an allocation program similar to that just issued by the FCC.

RADIO WILL PLAY A MAJOR ROLE in postwar employment, according to a survey just completed by the Radio Manufacturers Association. The survey reveals that 68.6% more men and women will be employed in the postwar era than in prewar. According to the survey 202 of the major radio companies expect to employ 145,266 during the first year of postwar production as compared with 86,-173 in the prewar year of 1940. Incidentally in the July-September, 1944 period, the radio industry employed over a quarter of a million people.

The 1300% increase in production is expected to decrease only 39.8% when peacetime arrives. The RMA survey indicates that this tremendous increase is due to the increased postwar demand that will certainly prevail.

RADIOSONDES HAVE PLAYED AN IMPORTANT ROLE IN THIS WAR. These important devices which check weather in the stratosphere have been serving us on all fronts with remarkable effectiveness. Recently captured German and Japanese radiosondes indicated further emphasized U. S. superiority. Most of the enemy models were found to be handmade and not designed for mass production. In addition they provided fewer readings and were not as accurate. The Germans appear to have two types in general use; one employs wet and dry bulb mercury in glass thermometers for measuring temperature and relative humidity, and another has a mercury filled glass manometer for determination of pressure. These glass tubes have metallic coils on the outside distributed through the operating length of the mercury columns within the glass tubes. Two transmitters are used, and two frequencies and two antennas are required. War Department officials stated that probably constant tracking of the signals at the ground station is required to operate this set. The Japanese unit is very similar to the German and here again they have the same defect as the German type, in that they also operate on two frequencies, requiring two transmitters and two antennas.

The American equipment employs but one transmitter. The carrier frequency is audio modulated and variations in audio modulations are translated into meteorological data. The signals are received and graphically recorded on a chart.

In contrast to the 7 contacts used on Japanese and German equipment, our radiosondes have from 80 to 95 contacts. Vibrators and transformers are employed by the Japs and Germans while we use batteries with the correct plate voltage to secure the necessary power.

Television

THE FCC ALLOCATION PROPOSAL REVIVED DISCUSSION OF LINEAGE and ultra-high frequency powers. Although a short while ago ultra-high frequency high-powered transmitters were but in the discussion stage, it now appears as if they are an actuality and await only the war's end for development and production. A recent talk by Brig. Gen. David Sarnoff of RCA disclosed that a 300-megacycle transmitter using 5 kilowatts had been developed in the laboratories and will be available soon after war's end. Other manufacturers have also indicated that high powers at the high frequencies will be available soon after war's end.

Several weeks ago we were told of the 1,000-line television system that had been developed by Rene Barthelemy, chief engineer of Companie Francaise de Television in Paris. The existence of such a high-definition system was at first denied but later reports indicated that such a system was possible and available. It appears as if some American engineers have seen the French system and found it quite satisfactory. A direct viewing system is employed by the French engineer according to reports. The American engineers also stated that a projection system was also developed and demonstrated with excellent results.

Inquiry among American engineers indicated that although few laboratories have experimented substantially with this very high form of definition, methods of achieving this are known and may be applied to systems soon. The ultra-high-frequency channels assigned by the FCC would fit admirably into a transmission method where such high definition was provided.

In England they are talking of high definition pictures too. Speaking before the Institution of Electrical Engineers in London, D. J. Edwards advocated an 800-line picture, with a bandwidth of 20 megacycles and a carrier frequency of several hundred megacycles. Mr. Edwards also pointed out that radio links using ultra-high frequencies would ultimately be used for network distribution in place of coaxial cables. Discussing a program for postwar television, he offered two

alternatives. One provided for transmissions on the old standard for five years, with the development of an improved system to run concurrently The second provision called for experimental transmissions of an improved system within one year which he says will be possible in view of the technical resources that have been built up during the war.

THEATER TELEVISION WAS CONSIDERED AS BEING still in the experimental stage by the FCC and therefore no specific frequencies were allocated in the allocation proposal. However, the Commission indicated that they would give consideration to applications for experimental authorization on the 480-920-megacycle band, involving intracity transmission which included studio-to-transmitter, remote pickup, and intracity multiple address stations. These frequencies incidentally were allocated to broadcasting and when they are needed for the broadcast service, will be used by them exclusively. At that time the higher frequencies of 1900-2300, 3900-4540, 5750-7050, 10,500-13,000, 16,000-18,000 and 26,000-30,000 megacycles may be used for experimenting with intracity and intercity relay of theater television.

Personals . . .

Ken. Bureaw. former sales manager of Radiart has joined Cornell Dubilier as sales manager of the jobber division . . . **Roger M. Wise** is now vice president in charge of engineering at Sylvania . . . **A. M. Wiggins** has been named chief research engineer of Electro-Voice Corp. . . . **Max E. Markel** has joined RCA as specialist on industrial tube applications. Mr. Markel was formerly chief of the vacuum-tube section of the U. S. Signal Corp. at Camp Evans, N. J. . . . **Col. George C. Hale** is now with Emerson Radio as director of a special products division . . . **Jack Gaertner,** formerly of Emerson Radio, has joined the Electronic Corp. of America as sales manager . . . **B. J. Thompson,** associate research director of RCA, was killed recently in an Army plane in the Mediterranean area. In 1936 Mr. Thompson had been awarded the Morris Liebmann memorial prize by the Institute of Radio Engineers for his contribution to the u.h.f. field of radio. His research resulted in the development of the acorn tube . . . **Wilbur L. Nelson** has become mechanical design engineer of the Andrew Electronics Co. in Chicago . . . **Miles V. Barasch** has been appointed chief engineer of Sherron Electronics Co. in Brooklyn . . . **Dr. Donald B. Sinclair** is now assistant chief engineer in charge of circuit development at General Radio . . . **A. J. Monack** has been elected vice president in charge of engineering of Mycalex Corp. of America . . . **Otto Paschkes,** president of the Solar Corp., recently celebrated his twenty-fifth year in radio.

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Capt. C. F. Morris and Chief Neil F. Anderson of the Pasadena police force, use the handie-talkie as an aid in traffic regulation at the Rose Bowl game.

Pasadena Police Adopt Handie-Talkie

A PREVIEW of possible post-war use of one item of essential war equipment was offered at the Rose Bowl game in Pasadena, California, on New Year's Day when Motorola handie-talkies, compact two-way radio transceivers, were used to direct the heavy flow of traffic.

Neil F. Anderson, Pasadena police chief, directed operations from atop the Rose Bowl press box where he could watch all principal traffic approaches. Using a handie-talkie he was in constant communication with Captain C. H. Morris, in charge of traffic on the ground, and was able to issue instructions for rerouting traffic whenever it threatened to overburden any one artery.

The handie-talkies were furnished to Anderson and his staff by the Galvin Motorola-Radio Corporation which manufactures the sets for the United States Army Signal Corps. The battle-tested equipment has proved particularly valuable in beachhead landings and for scouting parties where instant, short-range communication is necessary.

A crowd of 94,000 set an all-time high attendance record at the Rose Bowl game. It was estimated that 32,000 automobiles jammed the parking area and Chief Anderson reported that the handie-talkie proved an invaluable aid in directing the movements of the huge crowd.

"It enabled me to keep in direct contact with all of our foot and motorized police and the military police who were assisting in handling the crowd," he declared.

In addition to their regular duties, the military police in the area were responsible for keeping all main traffic arteries free so that the football crowd would in no way interfere with regular military traffic which passes through this important sector.

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Captain Morris receives traffic-routing instructions. Chief Anderson directed traffic from atop the Rose Bowl press box.

Television Equipment

(*Continued from page 47*)

pulse generator. The pulse generator and sweep circuits move the electron beam in accordance with the interlaced scanning system detailed in last month's installment.

(2) The photosensitive mosaic consists of insulated portions of very minute photosensitive elements (silver globules) which free electrons in proportion to the intensity of the light that strikes them. These freed electrons form a small space charge about the elements from which they are emitted; however, they are not displaced sufficiently to be attracted to the collector ring. It is only at the instant the point is scanned by the iconoscope beam, and further secondary electrons are freed, that a current flows to the collector ring completing a circuit to the first video amplifier, the photoelectric charge regulating the number of secondary electrons removed.

(3) The metallic signal plate is insulated from the silver globules by a mica strip, forming an effective capacitance which completes the video frequency circuit from mosaic to collector ring, to grid circuit of first video amplifier, to signal plate, and back to mosaic.

(4) The collector ring progressively collects the secondary electrons as the beam scans the mosaic. Thus, it is apparent that the electron beam of the iconoscope is not a direct link of the video signal circuit but is a means of progressively releasing a signal in proper sequence for effective amplification and transmission.

When no light is focused on the mosaic, secondary electrons are removed from directly beneath the electron beam by the impact of the beam, up to the point where the number of electrons leaving the mosaic equals the number of electrons being added by the beam. When the beam first strikes a point on the mosaic one electron will remove many more electrons from the spot; however, since the mosaic is an insulated surface, this particular spot is capable of providing only a finite number of electrons, so we find the spot assuming a positive charge which will increasingly oppose the emission of secondary electrons until a state of equilibrium is attained.

The electrons that are emitted either move to the collector plate or fall back on the mosaic indiscriminately. The secondary electrons returning to the tube screen charge the points upon which they fall negatively. Thus, as the beam is moved across the mosaic by the deflection circuits, the points under impact by the beam assume a positive charge while the remainder of the mosaic becomes less positive, or negatively charged.

When the surface is lighted, photoelectrons are emitted in proportion to

the intensity of the light, that is, the most brilliant spot will emit the largest number of electrons, and cause the spot to assume a more positive charge. This charge is restored to equilibrium by the beam as it scans the point. Thus, as the beam moves across the screen the number of secondary electrons emitted and the number of electrons required to produce equilibrium depend on the photoelectron charges.

The variations in spot charges as coupled to the signal plate through the effective capacitance between mosaic and signal plate plus the secondary electrons picked up by the collector ring, constitute the video signal applied to the grid of the first video amplifier. To increase the average video signal, bias lights (small incandescent bulbs) are placed behind the mosaic increasing the average illumination and signal. This method is conveniently used to control the average brightness by regulating the intensity of the bias light illumination.

The minute output of the iconoscope (approximately 500 microvolts) is increased in amplitude by four or five stages of video preamplification before it is transferred through coaxial cable to the studio control equipment—at this point the signal has been increased to approximately .1 volt. Thus the gain of the video preamplifier is approximately 200 which is extremely low in comparison to the gain of four or five stages of audio amplification. This limitation on stage gain is a result of the very wide band of frequencies which must be passed by the video circuits (30 to 5,000,000 cycles). To pass this wide frequency band with equal amplification, video stages have the following major design features:

1. Tubes have a high mutual conductance and low interelectrode capacities. The mutual conductance is the figure of merit of a vacuum tube as it represents how effectively the tube converts a small change in grid voltage to a large change in plate current. Interelectrode capacities are important as they add to the total distributed capacitance (input and output tube capacitance, wiring capacitance, parts' capacitance to ground, and stray capacitance) shunting the signal circuits. This capacitance causes degeneration of the higher frequencies as it presents a low-reactance path to ground. It must be held to a minimum.

2. Video amplifiers use a low value of plate resistor to equalize the frequency response. The low value of plate resistor minimizes the reactive shunting effect of the distributed capacitance at the higher frequencies. In using a low-value plate resistor it is apparent how necessary it is, to use a tube with a high mutual conductance, for a considerable variation in plate current is required to develop an appreciable voltage across the low plate load.

3. Video amplifiers use special high- and low-frequency compensating circuits to extend the high and low extremeties of the response characteristic. The loss in high-frequency response, caused by shunt capacitance, is compensated by a number of methods; one simple method is to place a small inductor in series with the plate resistor, causing the plate load to have a rising impedance with an increase in frequency. This rising characteristic increases the stage gain at the higher frequencies and compensates for the loss caused by shunt capacity. Loss in frequency response at low frequencies is caused by the rising series reactance of the coupling capacitors as the frequency decreases, and, is compensated for by inserting a plate decoupling combination which uses a relatively low value of plate by-pass capacitor (see Fig. 4); the rising characteristic of the plate impedance (increased reactance of plate capacitor as frequency decreases) again stepping-up the stage gain at the lower frequencies. The aspects of video circuits will be discussed in a later installment.

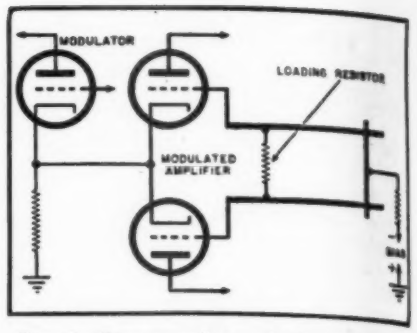

Fig. 5. Direct-coupled cathode modulator.

Since no transformer can pass the wide video range, a cathode follower transfers the signal from a high-impedance plate circuit to a low-impedance input circuit or coaxial line. The cathode follower, therefore, is a vacuum-tube circuit which functions as a transformer—the grid circuit having a high impedance which matches the high-impedance plate circuit of the preceding stage, and, a low-impedance cathode circuit which matches the coaxial line. Although the cathode follower has a stage gain somewhat less than unity its low-impedance output minimizes the effects of the shunt capacitance of the length of coaxial cable which couples the video preamplifiers to the control-room equipment.

Control-Room Equipment

The control-room equipment consists of the video line amplifiers and pulse generators, plus associated video faders, brightness controls, and shading controls. At this point the video operators monitor and correct the pictures picked up on the studio cameras. As shown on the photograph of the G-E control room the pictures from all the cameras appear on the control panel and the video operator chooses the proper one to convey the pertinent information at that instant. The control-room operator also adjusts the picture brightness, contrast,

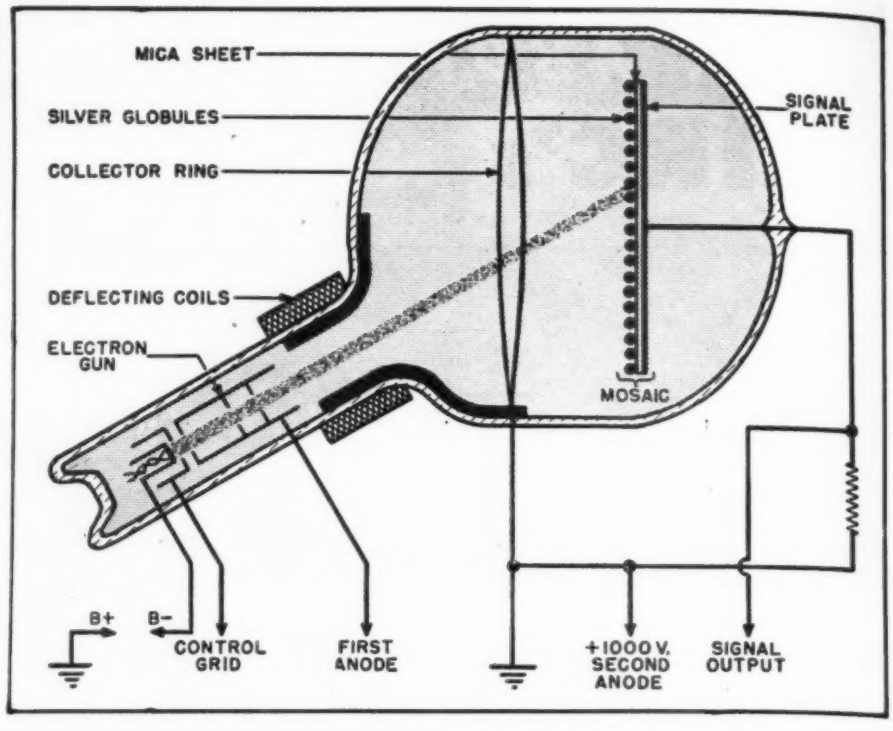

Fig. 6. Cross-sectional view, showing construction of an Iconoscope tube.

and shading. Audio gain controls and mixers are also a part of the control room equipment, as well as an interphone system to communicate between the program director, video operators, and camera operators.

In the video line amplifiers and mixers the sync and blanking pulses are added to the video signal from the studio cameras at the proper time and in the correct sequence. These pulses as previously explained also time the camera circuits so at the time the iconoscope is blanked, a blanking pulse is inserted into the transmitted signal, which, at the receiver, will blank out the picture tube. Likewise at the same instant the horizontal or vertical sweep circuit is hit by a sync pulse, a similar pulse is also inserted into the video signal and, at the receiver, hits the picture tube horizontal or vertical sweep circuits. The method in which pulses are inserted is shown in the partial schematic Fig. 3A.

Both the video signal and the pulses appear across a common plate resistor R, producing the waveform shown on the grid of the succeeding tube. However, the succeeding tube is a clipper and the video signal riding on top of the pulse is clipped off. The various other pulses are inserted in a similar manner. Thus, we find the output of our video line amplifiers is the composite television waveform, which is of a single polarity (varies from 0 to some positive or some negative value but never swings on both sides of an average zero value). The picture signal itself is sinusoidal and is contained within the area from 0 to the 75% level—the closer it approaches the 75% point the darker the signal it represents. Refer to drawing of composite waveform in last month's issue of Radio News.

The pulse generator is the timebase of the television system. It initiates the iconoscope sweep and blanking signals in conformity with the standard interlaced scanning pattern, and, simultaneously, generates sync and blanking pulses which are transmitted to synchronize the sweep and blanking circuits of the picture tube. The pulse generator is the most complex and interlocking circuit of the television system. To cover the pulse generator in detail at this point would find the average reader unable to cope with its complexities. Consequently, only the various signals generated and their purposes are mentioned at this time. All the various blanking, sync, and keying pulses are derived directly or through a divider system, from a 15,750 cycle (525 lines times 30 frames) sine-wave oscillator. An automatic frequency control system holds the oscillator on frequency, keeping the entire television system in tight synchronism. The various pulses generated are:

1. Iconoscope horizontal and vertical blanking pulses which blank out the iconoscope beam during retrace intervals.

2. Iconoscope horizontal and vertical sync pulses which pulse the horizontal and vertical sweep circuits of the iconoscope.

3. Transmitted horizontal and vertical blanking pulses which blank-out the receiving tube beam during the retrace intervals.

4. Transmitted horizontal and vertical sync pulses which pulse the horizontal and vertical sweep circuits of the receiver in synchronism with the iconoscope sweep circuits.

5. Equalizing pulses which equalize the retrace interval between fields with the retrace interval between

frames, preventing loss of synchronism under both conditions.

6. Keying pulses which are used within the pulse generator to key out vertical pulses during the horizontal intervals, to key out horizontal pulses during the vertical intervals, and to key in equalizing pulses at the proper time.

Transmitter

The transmitter equipment consists of a series of video amplifiers, modulator, high-frequency transmitter, sideband filter, and radiating antenna. It is located as close as practical to the radiating antenna to minimize losses and transmission line problems. At the transmitter a close watch is kept on the character of the transmitted signal—proper ratio of picture-to-sync, picture range and definition, pulse arrangement, correct modulation percentage, correct power output, etc. In many television installations elaborate test facilities are available which permit rapid switching of test oscilloscope or picture tube into various key circuits, permitting rapid isolation of defective sections. A transmitter man who understands all phases of the television system is invaluable, for from his vantage point he can see the television signal in its entirety and can be of utmost assistance in suggesting improvements and localizing trouble (both technical and production).

The television signal coupled from the line amplifiers in the control room through coaxial cable to the transmitter video amplifiers has a single polarity, that is, it swings from zero to some positive value or from zero to some negative value. Therefore, a new problem is presented in the transmitter video amplifiers for the signal must not be permitted to depart from this condition. Any signal can be held to a single polarity (fixed base line) with the use of direct-coupling, or, where capacitive coupling is used, a d.c. restorer must be connected into the circuit on the grid side of the coupling capacitor. If only a coupling capacitor is used the signal arranges itself as an average about the bias level set on the next stage (signal varies plus and minus the bias level). Since the actual bias is dependent on the average content of the signal a change in the average picture content would shift the bias level, which, in turn, would cause the level at which the picture tube blacks out to change. This condition would harm the picture fidelity as the black level must be held constant at the 75% point at all times.

Two methods of direct-coupling are shown in Fig. 3B. In the first stage the battery and cathode voltage set the bias on the tube, the grid signal strictly following the cathode signal as there is no charging circuit involved. The second stage, although it uses capacitive coupling, has a diode restorer which conducts whenever its plate swings positive. Thus, at any time the capacitor assumes a positive

charge on its grid side it is immediately discharged through diode operation. If a negative swinging signal appears at the output of the second tube the diode prevents the coupling capacitor from arranging the signal positively and negatively about the bias level of the last tube.

The television modulator differs from the audio modulator for it must be direct-coupled to the modulated stage. Generally, the modulator is a cathode follower which grid or cathode modulates the final r.f. amplifier. A typical modulator, as shown in Fig. 5, uses a common cathode resistor as a means of coupling the negative video signal in the cathode circuit of the modulator to the cathodes of the r.f. stage. It is apparent that the sync tips represent peak modulation percentage—this is termed "negative modulation" for the darker the scene becomes, the heavier the modulation is and the greater the power output.

Except for the final stages which must be broadly tuned to pass the wide picture band and the side-band filter across the output, the high-frequency transmitter is conventional. To transmit the wide sidebands linearly the grid or plate circuits of the modulated stages are loaded with shunt resistance (in high-powered installations this resistor is often water-cooled) or the drivers are tight-coupled to the modulated stage. Likewise the antenna and transmission line system must be flat over the same range of frequencies. Thus, the television antenna, although it is of a turnstile arrangement for best line-of-sight radiation, must have a conical or elliptical form, presenting a reasonably constant impedance to the transmitter over the transmitted band.

This month's discussion has covered those essential features of transmission which will assist in obtaining a more complete understanding of receiver operation. Next month's installment covers the over-all receiver operation and operation of the picture tube.

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Radio Industry Goes to Press
(Continued from page 45)

maintaining sound employee and public relations is evidenced in the fact that 5,000 house organs are published in this country representing some 4,000 concerns.

The "city desk" of these house magazines is usually comprised of an editor, one or two assisting editors (who are responsible for the editing and rewriting of material), and a staff of reporters who are willing and eager employees with a nose for news. Reporters are chosen from each department of the plant and feed their contributions to the "city desk." Most house magazines maintain a staff photographer who is especially important in adding interest with personal pictures of employees and their activities.

(Left to right) Herbert Hartley, works manager of the Hallicrafters Company, Chicago, and William J. Halligan, President of the company, accompany Major General H. C. Ingles, Chief Signal Officer, Army Service Forces, on an inspection tour of the plant, where mobile radio units and other critically needed Signal Corps equipment are being turned out in record time.

These house magazines have proven to be a morale builder to former employees in the armed forces. Servicemen are profuse in their gratitude for their publication because it keeps them in touch with their old friends "back home." Many a serviceman, learning that a fellow employee is at some overseas station from a letter that appeared in his copy of the plant's newspaper, has been able to enjoy a grand reunion. All organizations send copies to former employees in the armed services and many publish an overseas edition especially written for them.

Circulation of house organs in the radio industry runs all the way from a restricted number of 600, for employees only, up to 155,000 covering all employees, servicemen, distributors, suppliers, etc.

One of the largest and most impressive house organs published in the radio industry is THE SEEBURG VOICE started by the *J. P. Seeburg Corporation* seven years ago as a two-page mimeograph paper which has grown to its present thirty-two page planograph style. This streamlined magazine, edited by Claude Mason, has an editorial staff composed of an Editor, an Assistant Editor and six Associate Editors. Having four plants located in different sections of the city, an Associate Editor at each of these plants has interplant news fed to him from a staff of reporters under his direct supervision.

Headlining special features is a double spread on "Flashes From Our Friends In the Service" resplendent with letters and photographs from former employees now on the battle fronts. Women have their share in The Seeburg Voice with "Strictly Feminine," a column of do's and don'ts both on personal appearance as well as hints for homemaking.

THE HALLICRAFTERS TUNER, published by *The Hallicrafters Company,* first appeared in print under the title "You Name It" in August, 1942. A month later it was christened the "Tuner" after a heated contest carried on by means of the employees' suggestion system with a $25.00 war bond for the prize. It began with only four pages. Its size has steadily grown to an all-time high of twenty-four pages. It is printed by planograph process and has an editorial staff of 45 reporters, news editors and censors.

The "Tuner" stresses stories of the performance of Hallicrafters equipment on the battlefronts. One recent issue carried the story of the SCR-299 mobile unit when it transmitted a historic broadcast from the bomb-swept Anzio beachhead in Italy. Also of special interest to all employees is the "I'll Talk Plenty," a gossip column of sparkle and wit gathered from the various departments and plants.

A thirty-two page monthly entitled G-WHIZ is published by the *Guardian Electric Manufacturing Company.* Sprinkled throughout are pictures of personalities, social events, and news

flashes. Recently, G-WHIZ ran a series of construction articles on "How A Relay Is Made" giving employees an idea of what part their particular job plays in the finished product.

One of the few employee house organs not operated from a departmental staff is YOU AND BURGESS, edited and published as an advertising department activity of the Burgess Battery Company at Freeport, Illinois. It is an eight page monthly published for the express purpose of relaying to employees the importance of the product they manufacture in the war effort. Discussing the important part YOU AND BURGESS plays in personnel morale, Mr. C. E. Balz, Advertising Manager, says, "Dry batteries are a relatively unromantic item compared with tanks and planes and guns; yet, the need was so critical that we felt it advisable to carry in story form this vital need for our product."

THE STANCORITE is a colorful, sleek periodical for and about the employees of the *Standard Transformer Corporation.* Employees are kept better acquainted through the column of personal tidbits and photographs of social events.

The *General Electric Company,* for the past twenty-five years, has published both a monthly and a weekly periodical. The MONOGRAM, issued monthly, acquaints employees with engineering developments, research activities, unusual applications of their products, etc. G. E. NEWS is distributed weekly in ten separate editions, one in each of ten major factories and contains news of employee activities.

A little over a year old, alive and growing, is THE MAJESTIC MONARCH distributed to employees of the *Majestic Radio & Television Corporation.* In addition to regular established house organ features, gradually new ones are introduced from month to month keeping THE MONARCH flexible and of perpetual interest. To keep employees news-minded, a unique reporter sheet is enclosed with each copy carrying the heading: "Remember! The Monarch is your magazine. So jot down your news and give this sheet to your department reporter."

To acquaint employees with one another, AMERICAN PARADE published by *American Foundry Equipment Company,* incorporates within its pages "The Family Album." Each month this page contains a photograph of one of the company's many employees together with a complete biography.

To increase production and help win the war, the *Stromberg-Carlson* SPEAKER was launched February, 1943. Special care is given to the "human interest angle" with personal news, pictures and titles, cartoons, and similar material.

Enjoying the largest circulation in house organ publishing is the WESTINGHOUSE MAGAZINE with 155,000 copies distributed monthly to all employees at all plants as well as stockholders of the *Westinghouse Electric & Mfg. Company.* This house organ, handled by the Public Relations Department, is designed to be both informative and entertaining.

D. W. Onan & Sons was one of many in the radio and electronic industry swept along in the tide of war production expansion. With an increase of 169 employees before Pearl Harbor to a personnel of 2500 in a little over a year, the ONAN CURRENT NEWS became an indispensable institution. Preparation of its news is done single-handed by its Editor, Edwin C. Hirschoff, who is also responsible for the company's advertising and publicity. Periodically the editor makes the rounds of the plants for interesting stories and pictures of the employees. A headline story is contained in each issue and important news of Onan equipment in the various theaters of war is included.

The primary function of the RCA FAMILY NEWS is to present monthly an interesting and entertaining account of activities of employees at its Camden Plant. The RCA FAMILY NEWS made its initial bow in 1938 and has become one of the most successful in the field.

Started in 1942 by a boy in the Sales Department of *Shure Brothers,* SURE SHOTS grew from a few mimeographed sheets to its present printed copy with photographs. Although it contains a lot of news about the employees themselves and humorous, entertaining articles, it has also done an outstanding job in stimulating the morale and enthusiasm famous at Shure Brothers. Official photographs of the Army and Navy showing microphones and headphones in action are regular features. Stories of Shure Brothers' equipment on the battle fronts are included in practically every issue, thus making each employee feel that his job is vital to the victory for which we are all fighting.

The *Western Electric Company* publishes nine newspapers for the information of its 90,000 employees, namely: THE MICROPHONE, THE KEARNYGRAM, THE OBSERVER, GHQ, THE DISTRIBUTOR, THE POINTER, THE COMMUNICATOR, THE CABLEGRAM, and the LINCOLN CARRIER.

The above mentioned are but a few of the many house organs in the radio and electronic field playing their important part in Labor-Management relations. Others include: MICRO-TOPICS published by *Universal Microphone Company;* KELLOGG MESSENGER, *Kellogg Switchboard & Supply Company;* THE HICKOK COMMENTATOR, *The Hickok Electrical Instrument Company;* THE BEAM, *Sylvania Electric Products, Inc.;* PRESS WIRELESS SIGNAL, *Press Wireless, Inc.;* LIFE AT TUNG-SOL, *Tung-Sol Lamp Works, Inc.;* THE ELECTRONIC BEACON, *Electronic Laboratories, Incorporated;* THE ZENITH RADIO LOG, *Zenith Radio*

SECONDS COUNT

in fire fighting at 20° below zero

Scene above is of Boston Fire Alarm Headquarters. Chief Radio Operator is receiving verbal report of fire from Battalion Chief in his car at scene of fire.

One of many reasons why Boston installed

Motorola 2-WAY RADIO

• With a Motorola F-M Radiotelephone System, delays in locating the fire or in ordering equipment to the scene are ended. Battalion Chiefs are in instant touch with fire alarm headquarters.

Fire Fighting With the "Handie Talkie"—When Motorola Radio obligations to the armed forces are completely fulfilled, Battalion Chiefs will be in immediate touch with their men on the scene of action with the famous Motorola "Handie Talkie," an exclusive *Motorola First!*

Boston Installs Motorola System—The Boston Fire Dept. now uses F-M 2-way Motorola Radiotelephone, similar to the Motorola systems in use in 26 states. From Boston's Central Station, WEY, Fire Alarm Headquarters speak directly to the fireboats and 30 mobile units, Motorola equipped.

Now *your* Fire Department can also have its own modern Motorola radiotelephone system with certain limitations.

WRITE *today for full details*

GALVIN MFG. CORPORATION • CHICAGO 51

F-M & A-M HOME RADIO • AUTO RADIO • AUTOMATIC PHONOGRAPHS • TELEVISION • F-M POLICE RADIO • RADAR • MILITARY RADIO

Corp.; CROSLEY NEWS & VIEWS, *The Crosley Corporation;* THE UTAH "V" NEWS, *Utah Radio Products Co.;* ADMIRAL BROADCASTER, *Admiral Corporation;* THE DETROLA DIAL, *International Detrola Corporation;* FARNSWORTH EMPLOYEES VICTORY RECORD, *Farnsworth Television & Radio Corp.;* EICOR RIPPLES, *Eicor, Incorporated;* HOFFMAN TRANSMITTER, *Hoffman Radio Corporation;* J.M.I. FOLKS, *John Meck Industries;* MAGNAVOICE, *Magnavox Corporation;* AEROVOX NEWS, *Aerovox Corporation; and* THE SCOTT NEWS, *E. H. Scott Radio Laboratories.*

The popularity of any company publication cannot be questioned for even the most amateurish ones have a healthy following and become a good influence on the affairs of the company they represent. A house organ which is intelligently edited and which gives sympathetic treatment to news of employees and the company they work for, can be of tremendous help in traveling the necessarily rough road of reconversion.

This journalistic array should convince even the most doubting of Thomases that the company house organ is here to stay in the radio industry. When the final accounts are audited and the statistics completely compiled, their value in boosting production units in terms of employee morale, will give the "city desk" a prominent place in the radio and electronic manufacturing plant of tomorrow.

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Servicemen Organize

(*Continued from page* 39)

Members reported that a number of customers had commented on the advertisements, and had asked questions about the purposes of the association. The campaign is limited by the association's small budget, but it is felt that the expenditure is producing results and that under all conditions should continue.

Membership of the association is comprised not of dealers, but of servicemen themselves. Thus, an employer who is not personally a radio serviceman, may not become a member of RETA, but the store may display and use the association symbols if the serviceman who does the work is affiliated with RETA.

South Bend radio servicemen are enthusiastic over what they have accomplished so far. Their hopes for the future include an expansion of activities, with eventual statewide membership, and the aggressive cooperation of similarly-minded organizations throughout the country. Letters have been received from several states indicating a definite interest in this type of organization.

In addition to the officers mentioned above, the board of directors includes: Everett B. Dare, Claude High, Delbert Lear, C. Palmer, and R. W. Zeller.

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Television Receivers

(*Continued from page* 37)

to whether a rotary switch or a push-button type should be used is a controversial one. The rotary type is better from an electrical point of view, as it makes for less inductance in the switch itself, has a positive locking device, and in addition has the self-wiping feature; however disadvantages exist. It does not lend itself too readily to front panel design and layout, and must be tuned through all channels if one in particular is to be reached; therefore a muting device for both sound and video would add more to the original cost of the receiver.

From past experience we have found that the public has always accepted the push-button switch in any of its forms, especially the direct electrical contact type. This type also has its disadvantages. The large bakelite surfaces on which the contacts and shoes are mounted are very much affected by temperature or humidity and so affect oscillator stability; the contacts are not self-wiping, and, especially on the higher frequencies, are very noisy; so much so, in fact that merely walking across the room often upsets both sound and picture. This phenomenon would be overcome if a method could be found by which shoe and contact could be locked in position. Another fault of the push-button switch is the friction points between latch bar and push rod, and the end plates and push rods. By plating all moving parts this condition can be somewhat remedied, but not definitely cured, and becomes bad again, especially after the plating wears off. Long leads and high capacity to ground are instrumental in making design more difficult. Notwithstanding all these imperfections the engineers were forced to use this type of switch mainly because of pressure exerted by the sales department, which in turn is naturally influenced by dealers.

The design of television receivers is full of items which seem rather unimportant, but actually require much reflection. Something as insignificant as a pilot light can be most distracting when it glares at you in the dark while watching a program. It must be so situated that it can be seen if the receiver is accidentally left on, and still not be too noticeable while action is taking place on the screen.

Should a focus control or a line or field oscillator control be placed on the front panel? There are many different opinions on the subject. One of the largest radio manufacturers placed both field and line oscillator controls on the front panel, while another company insisted on placing the focus control on the front panel and mounting field and line controls at rear of chassis. The ideal television

receiver panel should consist of a volume control and switch, a light control, and a device to select stations. Refinements such as a tone control and a manual dial for tuning FM broadcasts can be added. No additional knobs should be considered under any circumstances.

What should the sensitivity of a television receiver be? This depends mainly upon the power of future transmitters. Past experience shows us that any sensitivity below 50 microvolts is rather useless due to the high noise level in present-day receivers. I believe that if and when we will have high-powered transmitters of 50 kw. or perhaps even 100 kw., nothing better than 100 microvolts on the receiver end will be required. This would generally assure a good picture in most of the service area, and greatly reduce echoes.

Another item is the installation. As pointed out earlier, an ordinary twisted pair is unsatisfactory for any reception above 70 mc. Inasmuch as we have television channels up to 108 mc. and higher, a serious problem presents itself in the cost of installation; unless the cost of "Copalene," "Intelin," or similar cable goes way down, and unfortunately this is unlikely, the installation price may well be between $50.00 and $100.00.

As there has been considerable talk of a postwar $200.00 receiver, an installation costing about half the price of the receiver itself is entirely out of line. Some way must be found for a lightweight, low cost, broadband antenna, and a good quality transmission line at about the price of the ordinary twisted pair. Of course, there is the possibility of excellent antenna systems being installed on top of the better types of apartment houses. This does not, however, solve the problem of antennas for television reception for the public.

In conclusion, it is my opinion that the following standards be adopted:

1. Amplitude modulation for picture.
2. Frequency modulation for sound.
3. Synchronization to be selected on the basis of merit.
4. Horizontal polarization, unless vertical is definitely proven superior.
5. Bandwidth to be 6 megacycles for a single channel, 12 megacycles for a double channel, used for color or high-definition monochrome.
6. Television to be in monochrome, at present, but color experiments to be continued on all channels with a view to using the double adjoining ones mentioned in this article.

Economic Aspects

And now for some facts based on actual figures. There has been considerable talk in many radio circles of a postwar $200.00 or even a $150.00 receiver. Admitting that this would be very beneficial to the industry, let us analyze how it can be done. Basing all figures on prewar experience, we

find that there were two manufacturers selling $200.00 television receivers at that time; however, these were table models with only five-inch tubes and admittedly were not sufficiently good to merit public acceptance. Taking these receivers as a basis, we will try to determine just what steps can be taken to heighten performance, improve appearance, and maintain price.

The number of tubes used in these sets was down to an absolute minimum, and was not sufficient to attain high standards of perfection; it is apparent that more must be added. Their cost was already down to rock bottom, making any thought of savings in that direction an impossibility; this leaves the question of which components we can look to for actual improvement on this new $200.00 receiver.

In my estimation, it can only come from the power supply, which in all probability will deliver a considerably higher voltage for the cathode-ray tube. This tube will cost only slightly more than the present type, but will have the price of the lens system added; thus we now have a power supply that is lower in cost but more than outbalanced by higher priced cathode-ray tubes and accessories.

To all components we definitely must add the additional labor cost of building the television receiver proper, which has been estimated conservatively by manufacturers to be about 25% to 35% higher than prewar figures; the inevitable 10% excise tax must also be taken into consideration. In summing up, let us assume that the dealer buying the $200.00 prewar receivers paid $100.00, we would then add 25% for additional labor, 5% additional excise tax (5% paid prewar) 25% additional overhead and another 25% to improve performance and provide large screen projection, and a final 20% to house the equipment in a console; our figure now is $200.00 cost to the dealer, meaning a minimum list price of $400.00. Although the customer probably could not know or understand this, he would get more for his money now than he received by purchasing the prewar $450.00 television sets. To this new figure we still have not added the cost of a FM or broadcast combination. Assuming that by making economies, manufacturers could find a way to add these features at no extra cost, we still find ourselves with this $400.00 list price. The addition of a period cabinet, record changer, or recorder, of course, will still increase the price.

One simple question now presents itself. What will the public accept as a television receiver? The only item of comparison we have is the prewar radio. Unquestionably the public has bought enormous quantities of $9.95, $14.95 and $24.95 receivers indicating that they were satisfied with the lower cost items. However, it would seem that these sets were bought either as a second or third radio in the home, or as a necessity due to lack of space.

I have frequently heard people say that they honestly believed that the $9.95 radio they purchased under a well-known name was the same product they bought years ago at $250.00; there is some truth to this; however, they really do not know that the same manufacturer has a line ranging from $9.95 to $750.00. A very large percentage of people also have what is commonly known as a tin ear, meaning that they cannot distinguish between good and bad sound, but I have yet to see people with the equivalent "tin eye." The eye is far more critical than the ear, and will not tolerate bad pictures. To sum this up, we find that the reasons for large scale sales in low-priced radios were as follows:

1. To be used as a secondary radio.
2. No space available for a large radio.
3. Misled by unscrupulous salesmen.
4. Tin ear.

Were we to manufacture television receivers as defective in pictures as low-priced radios are in sound, the public would be sure to discover this in record time through its own eyes. The picture must be bright, large, and have good definition, be steady, have a minimum of interference, and perform well in outlying locations. All these features cannot be accomplished in low-priced models, and it is doubtful if any compromise can be achieved.

On the other hand a program of public education by means of advertising can be undertaken. The first item to be overcome would be the common attitude, "I'll wait until the price goes down; my first radio cost $350.00 in 1926 and I just bought a better one for $49.95." The public is not expected to know that the $350.00 model actually was entirely out of line in price, consisting only of five tubes and very low component parts.

Because of the great strides taken in the past few years in radio development, people feel that by biding their time, they can eventually purchase a more perfected product at a lower cost. These impressions must be dispelled. The public must be shown that a television receiver is actually five or six high-class, present-day radios housed in one cabinet, using between twenty and thirty tubes, and that there is absolutely no sign or hope that good performance can be achieved with even half this amount of tubes.

The public must also be taught that a television receiver is built, not with the high-cost materials of twenty years ago, but with approximately the same parts of good present-day radios; in view of this we cannot hope for as drastic a price reduction as that which took place between 1920 and 1940! Education must overcome this unrealistic trend of thought.

I should like at this time to draw

Offner Electric Shock Therapy apparatus has been widely prescribed for treatment of psychiatric patients for more than five years. From the very first experimental model to present-day production units, Guardian Overload Relays have been used exclusively to protect the patient from dangerous current surges.

Offner Electric
Shock Therapy Apparatus

Relays BY GUARDIAN

In certain types of mental disorders it is possible to shock patients back to normal by passing an electric current through brain tissues. Naturally the patient must be protected against the possibility of excessive current surges. Such protection must be positive—dependable. In providing this protection, Guardian Series L Overload Relays have established a perfect record for safe, dependable performance in hundreds of thousands of known treatments.

The Series L Overload Relay provides accurate protection against surges and overloads. Standard coils attract on 150, 250, 500, or 750 milliamperes; coils for operation on other current values are available on specification.

The large, oversize contacts used on this relay can take severe overloads without damage. They are rated for 1500 watts on 110 volt non-inductive A.C. and in A.C. primary circuits of any inductive power supply delivering up to and including 1 kilowatt. Contacts lock open and cannot be reset until overload is removed. For further information, write for Series L bulletin.

Consult Guardian whenever a tube is used—however—Relays by Guardian are NOT limited to tube applications, but may be used wherever automatic control is desired for making, breaking, or changing the characteristics of electrical circuits.

GUARDIAN ELECTRIC
1630-C W. WALNUT STREET CHICAGO 12, ILLINOIS
A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY

an analogy. It is a fact that every automobile manufacturer who has attempted to put on the market an automobile considerably lower in price than the cheapest models available had to either withdraw it or go bankrupt. Car quality is something one can discover by use, despite all the salesman's glowing promises, and it is my opinion that the same will hold true for television; picture quality is an item everyone will be able to judge as the movies have already set standards for us. To return once more to the automobile industry we find that manufacturers produced thousands of cars per year (3,698,328 in 1940) at a price of approximately $1,000.00 each. A large percentage of these cars were bought for pleasure use, and of these the greater part was purchased by people of average means. This was made possible by the medium of installment buying, a highly successful American institution. If the public was only eager to buy the lowest-priced cars, the large percentage of "de Luxe" and "Custom de Luxe" sales would have been impossible. It is my firm belief that once the public has been educated to the point where they conclusively will know that they cannot expect quality below a certain price level, buying of television receivers, will speed up, helped, of course, by the "deferred payment plan."

Good programs will have to be provided simultaneously, just as good roads spurred the automobile sales skyward. To sum up, it is my opinion that the industry is on the wrong track in trying to provide "cheap" television, that the public probably will not accept. Educational advertising has worked miracles before, and can still be relied upon to put commercial television over the top.

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Saga of the Vacuum Tube
(*Continued from page 54*)

tion as a detector with 18 to 40 volts on the anode.

Type C—This was similar to type "A" except that the grid was of molybdenum instead of nickel of 22 turns with a pitch of .030 inch. It was to operate at anode voltage of 80 to 500.

Type D—This was the same as the unbased "Electron Relay" previously made by Moorhead.

Type E—This was the British Standard Type "R." It was similar to type "A" except that it employed a spherical bulb, and was based with the British standard 4-pin base.

Type F—This was similar to type "E" but with low vacuum, like type "B."

Type G—This was similar to type "C" but in a spherical bulb and with British standard 4-pin base. This was the same as the British Standard Type "B" tube.

The tubes advertised and sold by the Marconi Company in 1919 and early 1920 as the "Marconi VT" were Type "A" and Type "B" as described above. In the advertisements Type "A" was designated as "Marconi VT—Class II" and Type "B" as "Marconi VT—Class I."[245] A life of 1500 hours was claimed for these tubes.[246]

The first group of these tubes, about 25,000 in number, which were delivered to the Marconi Company, bore no Marconi or de Forest markings. They were stamped on the glass with the legend "Moorhead Audion—San Francisco." The cartons in which they were packed were marked to restrict their use to amateur and experimental purposes. About 8,000 of these tubes were sold. The balance had the words "Patented Nov. 7, 1905—Sold

A Golf Course serves as an ideal location for Tobe Deutschmann filter engineers in field-testing a military power plant, using a newly designed Filterette.

only for amateur and experimental use" stamped on the bulb before being sold.

Subsequently, the brass bases carried both the Marconi and de Forest markings, Fleming and de Forest patent numbers, and the restrictive legend. See Figs. 181 and 182.

The contracts between Moorhead Laboratories, the de Forest Radio Telephone and Telegraph Company, and the Marconi Company were cancelled on January 30, 1920 by the Marconi Company, the cancellation being effective, in accordance with the six months' clause, on July 30, 1920. This was probably done because the necessary de Forest license was in a fair way of being acquired by the Marconi Company's successor, The Radio Corporation of America, by virtue of the cross-license agreements between RCA, AT&T Co. and General Electric Company, concluded on July 1, 1920, a month before the cancellation finally became effective. A contributing factor to this cancellation undoubtedly was the fact that the Marconi Company experienced great difficulty in obtaining from the Moorhead Laboratories deliveries of sufficient satisfactory tubes to meet their demand. All the shipments received contained a large percentage of defective tubes, in some cases as high as 75%, which had to be weeded out before deliveries could be made to customers.

Meantime, the Moorhead Laboratories, early in 1920, underwent a reorganization and de Forest became associated with them.[247] Two distributing companies were formed, the "Pacific Radio Supplies Company" to handle business in the West and the "Atlantic Radio Supplies Company" to be the East Coast distributors.

The first tubes offered for sale by this combination were the unbased Electron Relay, shown in Fig. 178, and the "Moorhead VT Amplifier-Oscillator."[248] The unbased Electron Relay was soon replaced by another soft tube, also denoted as the "Moorhead Electron Relay."[249] Early designs of this tube had a cylindrical anode and spiral grid. Both grid and anode were supported only from the press, the upper ends being left free. This construction was extremely sensitive to mechanical disturbances, since the grid and anode were free to vibrate under mechanical impulses. Two tubes of this construction are shown in Fig. 181. They differ in the fact that the surfaces of the anodes are unlike. That at the left in the figure has a glossy, almost polished, surface, whereas the one at the right has a dull, possibly oxidized finish. It will be noted also that the diameter of the anode was somewhat greater than that used in the hard amplifier tube.

A later type of Moorhead Electron Relay, in which steps have been taken to reduce the sensitivity to mechanical disturbances, is shown in Fig. 182. In this tube the anode structure has been extended at the top to permit the addi-

tion of a mica spacer to position the grid more accurately with respect to the anode and to provide mechanical support. Also the bottom of the anode has been extended in the form of two tabs which are bent to rest against the sides of the press, and thus provide stiffening for the element assembly to some extent.

The other tube which was offered for sale at this time, the "Moorhead VT Amplifier-Oscillator," was the same as the Marconi VT—Class II.

Beginning with the August, 1920 [250] advertisement, these tubes were designated as the "A-P Electron Relay" and "A-P Amplifier-Oscillator" and were represented as being licensed under the de Forest and Fleming patents. This was misrepresentation, since the license under the Fleming patent had been cancelled as of July 30, 1920. The December advertisements [251] announced the "A-P Transmitting Tube," which was the same tube as had been made for the Marconi Company under the designation "Type C" above. This also was represented as being licensed under the Fleming and de Forest patents. See Fig. 183. Still another tube, designated as the "A-P Rectifier" was advertised as shown in Fig. 184, in May and June of 1921.[252] It will be noted, however, that this advertisement makes no claim as to license.

Shortly after these advertisements began to appear the Moorhead Laboratories were notified by the Radio Corporation of America, successor to the Marconi Company, that these tubes were not licensed under either the Fleming or de Forest patents. The finances of the Moorhead Laboratories were in a chaotic condition, and the business was being managed by a stockholders-creditors committee, of which Henry S. Shaw was the Chairman. Considerable stocks of raw materials were on hand and the indebtedness was large. In order that the situation might be cleared up to the benefit of all concerned negotiations were entered into and the Radio Corporation granted to the Moorhead Laboratories a license, dated January 25, 1921, under the Fleming and de Forest patents, for the manufacture and sale of a limited number of tubes. This license was delivered to the Moorhead Laboratories in July of 1921, and subsequent advertisements stated correctly that the tubes were being made and sold under license from RCA.

After this license had run its course the Moorhead Laboratories consented to an injunction restraining from the further manufacture or sale of vacuum tubes.

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CAPTIONS FOR ILLUSTRATIONS

Fig. 176. Advertisement announcing Moorhead Tube with external control electrode. Reproduced from page 355 of September, 1916, Electrical Experimenter.

Fig. 177. Moorhead Tube with external control electrode. Bottom—with control electrode removed. Note raised marking on anode. Top—complete tube assembly. Photograph courtesy Bell Telephone Laboratories.

Fig. 178. Moorhead Electron Relay, original unbased type. Note marking "ER" on anode. Photograph courtesy Bell Telephone Laboratories.

Fig. 179. Moorhead version of British Type "R" in spherical bulb.

Fig. 180. Marconi VT.

Fig. 181. A-P Electron Relays. Left—with glossy surfaced anode. Right—with dull surfaced anode.

Fig. 182. A-P Electron Relays. Right—same tube as at right in Fig. 181, but turned 180 degrees to show de Forest marking on base. Left—improved construction with mica spacer and bracing tabs. Anode is aluminum.

Fig. 183. Advertisement announcing A-P Transmitting tube. Reproduced from page 389 of December, 1920 RADIO NEWS.

Fig. 184. Announcement of A-P Rectifier Tube. Reproduced from page 911 of June, 1921 RADIO NEWS.

(To be continued in May issue)

Servicemen's Multimeter

(*Continued from page 42*)

at end of article, have suggested a means of using the second diode section of a 6H6 to develop a contact potential equal to the offending contact potential which may be applied in series differential with the unwanted potential. The value of R_{15} depends upon the particular tube, and must be determined by trial while constructing the instrument. Its size will usually lie between one and fifty thousand ohms for most tubes.

To determine the correct value for this resistor after the d.c. voltmeter section is completed, connect a variable resistor (say 50,000 ohms) in position R_{15}, apply no voltage to the voltmeter and adjust R_{28} until there is no deflection of the voltmeter. Check this setting by switching the meter to d.c., carefully rezeroing, and then switching to a.c. If the value of R_{15} is correct, complete balancing out of contact potential will be indicated by no deflection of the meter.

Construction may follow simple established practice. Since no radio-frequency signals ever reach the tracer amplifier proper, few precautions concerning feedback need be observed. It will be found, however, that the a.f. gain is so great that parts layout to avoid magnetic and electrostatic hum fields will be required. It is quite possible that the constructor will have a junk receiver which will supply most of the required parts. In this case the power supply and last audio stage may be left intact, while the first audio stage will probably only require tube substitution to a high-gain pentode, such as a 6J7 or 6SJ7.

Construction of the "detector-a.f. probe" can follow many mechanical plans which will present themselves to the reader. Perhaps the simplest is the use of a shielded Amphenol octal socket of the type used for some tuning-eye applications, a tube shield, some insulating washers, a 6-32 machine screw and several nuts. On the original a metal washer, which is a fairly snug fit for the top opening of the tube shield, was selected and sweated into the opening.

To the soldering lug inside the tube shield is soldered a small mica capacitor, C_1. The other terminal of this condenser is soldered to a short length of hookup wire and to one terminal of R_1. The other terminal of R_1 is pulled through a small hole punched in the tube shield, soldered, and filed off smoothly. A grid cap is soldered to the short length of hookup wire and slipped over the top cap of the 6F5 probe tube. A light strip of metal (one of the ground straps furnished with all Centralab controls is excellent) is formed to slip over pin No. 1 of the 6F5 and bent sharply up the tube base to solder to the tube shield. The Amphenol cap should be bonded to pin No. 8 of the 6F5 socket. The probe point may be provided with two interchangeable extensions. A phone tip tapped to fit the 6-32 screw makes a good short extension.

A 4-inch length of 6-32 all thread, insulated with cambric tubing (spaghetti), filed to a sharp point at one end and provided with a coupling collar at the other end, makes a long enough extension to reach those hard-to-get-at signal points in a crowded chassis. The coupling collar is easily fashioned from the barrel of another phone tip, cut off and tapped at each end.

A ground lead is brought out of the front panel and terminated in an alligator clip. This lead is normally clipped to the chassis of the receiver being serviced, providing return circuit for signal tracing and voltage measurements. It will be necessary to disconnect this ground clip from the receiver chassis when making resistance measurements of components of the receiver chassis.

The voltmeter probe is easily constructed using any test probe having a fairly large diameter insulated handle. A small (¼- to ½-watt), one-megohm resistor is connected to a suitable length of test lead and pulled down into the test probe. Shielding of this lead may be desirable.

A total of three test leads are required for the instrument. Two regular test leads are used for the "ohms" function, while the one special lead just described is used

in conjunction with the ground lead for "volts" measurement.

Looking at the front panel, the controls are zero (R_{25}) to the left of the meter for balancing the voltmeter circuit, and ohms (SW_5) to the right of the meter for selecting the resistance range (the zero-ohms control R_9 is on the rear chassis drop). The polarity switch (SW_4) is at the left of the a.f. gain control and on-off switch at the lower center of the panel (mounted directly to R_4). The volts range selector switch (SW_3 is at the right of the gain control (R_4). The ohms pin jacks are in the lower left corner. The pin jacks in the lower right corner are volts (V) and plate (P). The (V) pin jack is for use with the electronic voltmeter probe, the (P) pin jack connects through a suitable coupling capacitor back to the plate of the last stage of the tracer section. By inserting the probe of the electronic voltmeter into this plate terminal, and throwing the a.c.-d.c. switch (SW_2) on the back chassis drop to a.c., the electronic voltmeter may be used as an output meter for alignment purposes. One advantage of this method is that no connection need be made to the receiver being aligned. When the tracer probe is brought close to the last audio stage, sufficient signal is picked up to actuate the output meter.

A clamp bracket fastened to the front panel makes a convenient holder for the tracer probe when not in use. Metallic rattle so common to a small metal cabinet (8½"x7½"x7") of this type was eliminated by mounting the speaker on a masonite panel which was in turn fastened to the top of the cabinet. Black cambric serves as a dust cover for the speaker while mechanical protection is provided by ⅛" hardware cloth.

Tubes of similar characteristics to those indicated may be substituted. One precaution must be observed: the power rectifier tube must be an indirectly heated cathode type. If a filament-type rectifier tube is used, full "B" plus will be applied to the meter

Fig. 6. Cross-sectional view of the v.t.v.m. probe, showing details of construction. Resistor R_{11} should be 1 meg.

circuit before the '76 tube comes up to operating temperature. During this interval the plate resistance of the '76 tube will be abnormally high, and the bridge circuit will be unbalanced to the extent that damage to the meter movement may result.

It has already been indicated that the tracer section can be used to "listen" to the signal at any point in a receiver. Distortion or hum can thus be traced to the stage in which it first occurs. The tracer can also be used to check the filter sections of a power supply by noting the normal reduction of hum as the probe is moved progressively through the filter system. If

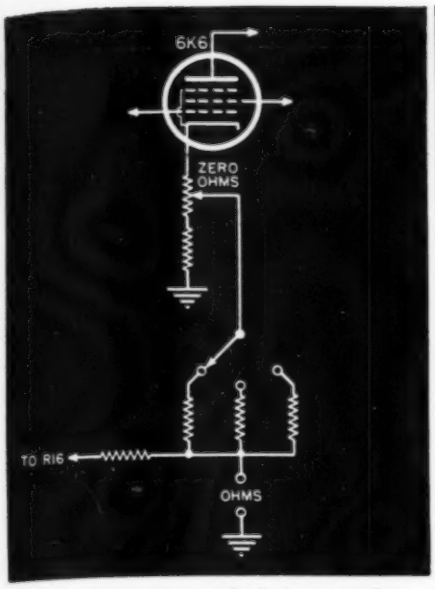

Fig. 7. Alternative method of wiring ohmmeter circuit. This method should be used when zero ohms of your ohmmeter scale correspond to zero-scale deflection.

some filter section fails to produce a marked reduction of hum, the capacitor of that section is suspected. The effectiveness of by-pass capacitors can also be checked by noting the absence or presence of signal at the by-passed points. If a signal is found to exist at a by-passed point, by-passing is inadequate.

The electronic voltmeter can be used for routine voltage measurements. The a.v.c. system can be checked by measuring the a.v.c. voltage while tuning to stations of different signal strengths.

Frequently a receiver will work well at some portion of the broadcast band but will fail to operate at some other part of the band. Measure the d.c. voltage at the control grid of the oscillator as the receiver is tuned through this critical point. A negative voltage should appear at the oscillator grid at all dial settings. Should this voltage cease or drop to a very low value, the oscillator has dropped out of oscillation or the depth of oscillation has diminished to a value inadequate for heterodyne conversion. Replace the tube and recheck. If this fails, check the various components of the oscillator circuit for leakage, moisture or shorts.

Leakage in coupling condensers is easily indicated by removing the tube following the condenser and checking the voltage at the grid terminal of the socket. A d.c. voltage (usually positive, negative in case of coupling from a diode detector) indicates a leaky coupling condenser which should be replaced. Some circuits using bleeder-return biasing are exceptions to this method.

REFERENCES

(1) *Laboratory Type V.T.V.M.* McMurdo Silver. *Radio News, September, 1943, page 32.*

(2) *Adaptors for Voltohmyst Junior.* Guy Dexter. *Radio News, June 1944, page 35.*

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QTC

(*Continued from page 55*)

recruitment demands to 80,000 per month. Selective Service also at the same time ordered the re-examination of all draft registrants 18 through 29 who have been rejected since Feb. 1. Men in the radio industry ashore, however, when transferring have gone from one war plant job to another in most cases.

Manpower shortages have hit the shipyards in some cases to a very serious degree. For example, Federal Shipbuilding and Drydock reports a lack of workmen, two to three thousand being required. Bethlehem Steel's Shipbuilding Division likewise reports that the manpower problem is getting to be the controlling factor in production. At one East Coast port recently absenteeism among stevedores ran up to fifty percent; soldiers of the Transportation Corps loaded ships in order that there would be no delay.

ATLAS Corporation has purchased Tangiers Radio station, according to a recent announcement, and plans to install and operate stations in various parts of the French Empire.

RTPB plans for establishment of three new frequencies in the low-frequency end of the present broadcast band might interfere with auto alarms it was pointed out by H. V. Looney, FCC Engineer. The proposal was for new bands at 520, 530 and 540 kc.

J. R. NEAIL, radio operator-gunner aboard a B-24, has been promoted to Tech. Sgt., it was reported from his base. John holds the Air Medal. William Hanford, of Press Wireless, was wounded in December while at the front lines in Europe. Hanford went in a few days after "D" day with a transmitter on the beachhead. K. J. Smith has recently completed the radio school course at Scott Field and is now a radio technician.

WPB announced that over nine-million receiving tubes will have to be produced during the first three months of 1945 if present requirements are to be met. Tube production has been below the requirements and it is believed that production for civilian use will be very limited, even after "V-E" day . . . 73.

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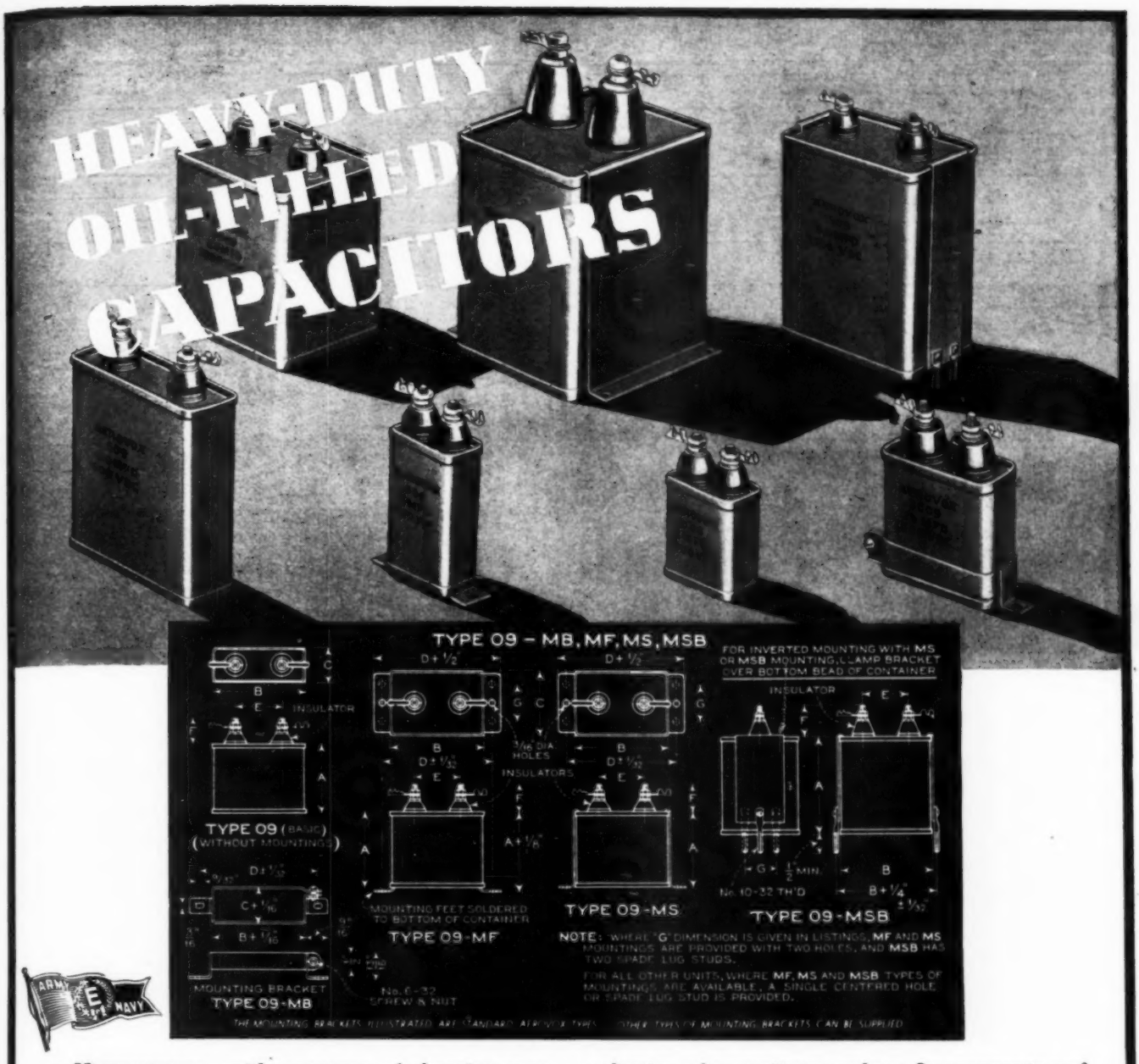

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	Dual Units	.05, 0.1,	"
	Triple Units	.05, 0.1,	"
1,000 VDC	Single Units	.05, 0.1	Mfd.
	Dual Units	.05, 0.1	"
	Triple Units	.05	"

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TEST VOLTAGE . . . . . twice DC rating

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OPERATING TEMPERATURE . . . 55°F. to 185°F.

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.05 to 0.1 Mfd.—20,000 Megohms
.25 Mfd. —12,000 Megohms

POWER FACTOR . . 1,000 cycles—.002 to .005

CONTAINER SIZE:
Width 9/16," length 1-11/16," height 1-17/32"

MOUNTING HOLE CENTERS . . . . . 2-1/8"

Illustration shows capacitor with bottom terminals. Capacitors also available with top terminals.

OD-CAPACITOR

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